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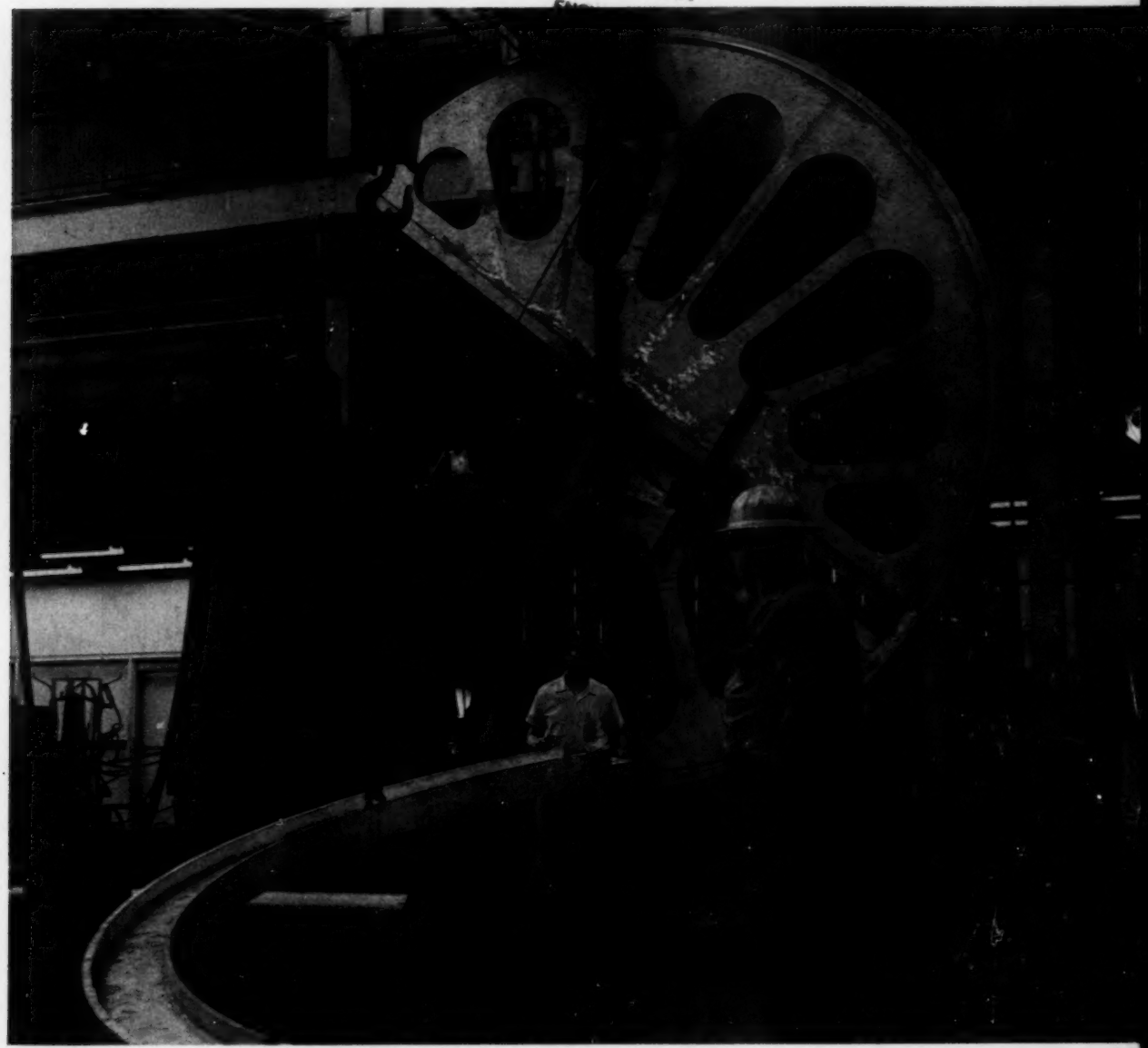


Contour milling an aluminum welding jig for Saturn, see page 1

Welding loaded rocket containers, p84

Take the guesswork out of assembly, p95

NEW COST CUTTING TOOL

Special Report, p103

INTERNAL GRINDING...

Are Two Wheels Better Than One?

by George H. Lockwood
Manager, Research & Development
The Heald Machine Company

Until very recently, internal grinding of a straight or taper bore has always been done with a single grinding wheel. Although this method has worked very well and will continue to be widely used, it is subject to inherent limitations under some circumstances.

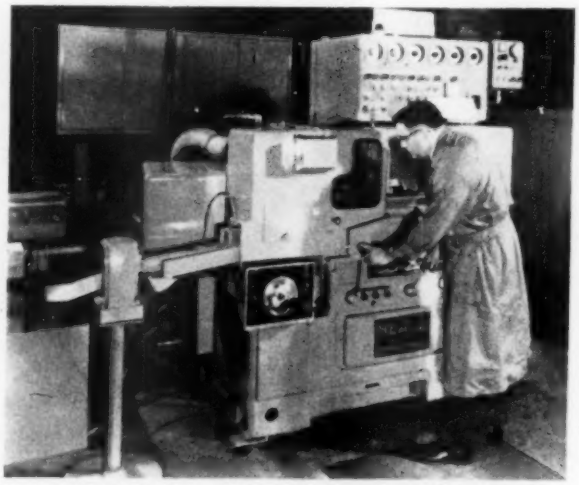
In the first place, using the same wheel for both rough and finish grinding requires a compromise in grit selection. A wheel coarse enough for maximum efficiency of stock removal in the roughing portion of the cycle may not give a sufficiently smooth surface for the finish grinding operation. So grinding speed must be weighed against surface finish, and a suitable compromise selected.

Secondly, in single-wheel grinding the wheel is usually dressed between the rough and finish portions of each grinding cycle. This increases the total cycle time by the time necessary for the dressing operation.

Both of these limitations have been removed by a unique double-wheel grinding arrangement which was first demonstrated publicly by Heald at the 1960 Machine Tool Exposition. This setup uses a single wheelhead with two separate wheels mounted on the same spindle—one for rough grinding and the other for finish grinding (see diagram below). Actual wheel specifications can be determined on the basis of maximum performance—a coarser roughing wheel for faster stock removal and a finer finishing wheel for a lower micro-inch finish. Change from rough grinding to finish grinding is simply a matter of automatically changing the position of the machine table, with no interruption of the cycle. Both wheels are dressed while the work is being loaded, hence dressing adds no time to the cycle. This represents a significant reduction in overall cycle time.

With these resultant advantages—more efficient rough and finish grinding plus no time out for dressing—a workpiece that would ordinarily require 25 to 30 seconds on a single-wheel machine, can now be ground in less than 10 seconds by the two-wheel method.

This new method is ideally suited to high production runs where maximum output is essential. But it is not the universal solution to all grinding problems. Wheel costs may run somewhat higher, since both wheels are normally dressed during each cycle and as much is removed from the finishing wheel as from the roughing wheel. An economic study of your particular requirements will show which method—one wheel or two—will yield the maximum return on your machine investment.



Heald Model 190A Centri-Matic internal grinding machine arranged for high speed double-wheel grinding of bearing races.

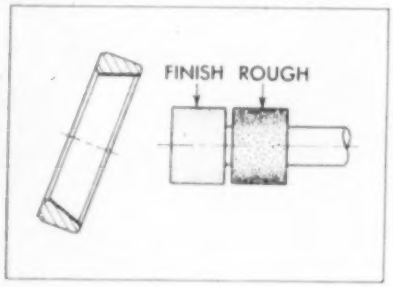


Diagram of double-wheel setup for grinding taper I.D.s of bearing outer races. The roughing wheel is mounted nearest to the wheelhead to reduce spindle deflection under heavy feeding pressure.

Your Heald engineer will be glad to tell you more about this interesting development. **It PAYS to come to Heald.**

THE HEALD MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
WORCESTER 6, MASSACHUSETTS

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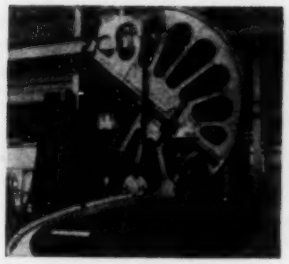
COVER:

Welded aluminum structure machined on Keller machine at Douglas Aircraft is part of welding jig to assemble the 18-ft dia, 6-segment, Saturn bulkhead.



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METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

FORMING . . . A massive machine powered with a 50-hp motor will thread-roll high-strength studs up to 6-in. diameter for nuclear power equipment and turbines. Landis Machine Co has successfully rolled 4-in. dia, 8-pitch threads 4¼-in. long on machine that will thread heat-treated steels of RH 32 to 36 C. The machine, which has 6-in. capacity for in-feed rolling, will **do through-feed rolling of long bars up to 4 in. in diameter.**

COMPONENTS . . . Micrologic flip-flop may reduce computer cost by 70%, according to Fairchild Semiconductor Corp, subsidiary of Fairchild Camera & Instrument Corp. The element, first of six molecular electronic components, is a switch that channels current in different directions and is **expected to reduce the size of the logic, or arithmetical calculation, section of computers.**

MATERIALS . . . Filament windings already replace metals for containment vessels and thrust chambers, and applications should increase. The ASME Aviation Conference was told that glass filaments and epoxy resins are usual materials. Advantages: **They are lightweight, low-cost, non-strategic; tooling is inexpensive.**

FINISHING . . . The flash from Neoprene O-rings is removed by vibratory barrel finishing in a new application developed at Pangborn Corp, Hagerstown, Md. The firm's experimental department tries to **save money in burr removal, improve surface finish, and remove fine chips that impair a product's usefulness.** Other products being tested: stamped bearing cages, hedge-shear blades, broached gears, die-cast servo bodies, vaned impellors.

INSPECTION . . . Surface finish indicator weighs only 5½ lb, gives measurements from 1 to 1000 micro-in. at any point on a production line. The stylus tip—an 0.005-in.-radius sapphire—**detects variations of ½ micro-in. within measurement range.** Built by Brush Instruments, the transistorized, battery-powered instrument gives a direct meter reading of finish or maps a profile when connected to a direct-writing recorder.

MANUFACTURING CONTROL . . . Four out of five plant accidents are caused by people—not hazardous conditions. This startling statistic forced one company to embark on a new type of safety program—one that has paid off in drastically reduced compensation payments and fewer major accidents. One key element: **Each foreman, not the safety director, is responsible for safety.** For full details, see p81.

COMPONENTS . . . Cam-driven function generator equals a "programmer" using a regular 3D cam, but is less expensive and far more flexible. Priced at $1500, the generator from Arma Div of American Bosch Arma Corp contains 35 individual single-turn cams, in a four-in.-long magazine, grouped on a common shaft to form a continuous spiral. The unit **can program several million simultaneous or sequential functions.** The device, permanently programmed for a specific task, is intended for long-run operations.

FORMING . . . Ice is the lubricant for stretch-forming stainless and titanium alloys at Sheffield University, England. There is no scratching or staining of the metal, and virtually no springback. The **coefficient of friction of a 2mm layer of ice is so low that it cannot be measured.** In the forming operation, infra-red heat (15 w/sq in. for 30 sec) is applied to melt the ice surface, and still further reduces friction.

ASSEMBLY . . . Automatic assembly of a complex automotive switch will eliminate all but 3 of 35 people, and produce a more reliable product. A two-stage machine assembles and stakes contacts into a plastic block, assembles a smaller component and inserts it, and **inspects for quality in the process.** To conserve space, the Hudson Div, Emhart Mfg Co, will build the 14 pc/min machine in a U-shape.

MATERIALS . . . Reinforced plastics are used as cold air deflector nozzles in jet engines at Bristol-Siddeley in Britain. Bristol and Rolls Royce are both **developing glass-fiber reinforced plastic for rotor compressor blades,** as well as for lightly loaded sections of the casing, and possibly for inlet guide vanes.

HEAT TREATING . . . Automatic control of quenching press reduces scrap and gives distortion-free crown wheels and other gear parts for Ford's Dagenham, Eng, plant. The three-stage quenching operation becomes fully automatic because **radiant energy from workpiece, heated to about 1610 F, focuses on an infra-red detector which transmits a signal** to a Minneapolis-Honeywell Electronik indicator-controller. When temperature drops to 1510 F, the cycle starts—work is clamped and moved horizontally, oil inlet valves open in sequence. **If workpiece is below 1510 F, cycle does not start.**

CUTTING . . . Surface grinding CI at ¼-in. depth-of-cut and feed of 2 fpm has been done by Landis Tool Co, Waynesboro, Pa; 0.10 in of steel is removed at same feed. A 18 x 3-in. resinoid-bonded wheel is driven at 900 rpm by a 15 hp motor, feed is hydraulically powered, work is held in a fixture or a magnetic chuck. **One example of use: hogging excess stock off die blocks.**

WELDING . . . Cases loaded with solid rocket propellant are welded shut at Rocketdyne, McGregor, Tex, in a tricky, remotely controlled operation that provides maximum safety for the operator. Development work also showed how to **preserve the strength of the heat-treated turbine starter cases.** See p84 for the details.

INSPECTION . . . The number of razor blades per package is measured by electrical impedance, as sealed packages move along a conveyor, at Unilever, NV, Holland. Conventional X-ray or weighing methods were unsatisfactory because of variations in the steel. **Packages are checked 3 a sec** by comparison with a known sample, with a 2 mc source.

Continued on next page

Coming in AM/MM

- *How to maintain progressive dies*
- *Reliability fact or fad?*
- *Vapor degreasing — A Special Report*

METALWORKING REPORT . . .

MATERIALS . . . New 18%-nickel alloy steel gives greater combination of strength and ductility than any other material. Developed by International Nickel Co, Inc, the alloy has a yield strength of 250,000 psi plus the toughness and ductility now limited to alloys of only 150,000 psi yield. It is **especially suited to high-stress and sudden-shock applications** because it resists notching and cracking. It is not intended to provide strength at high temperatures, but its properties are good to somewhere near 1000 F. Analysis: Ni, 18%; Co, 7%; Mo, 5%; Ti, 0.5%, or less; C, 0.05%, max.

WELDING . . . Aluminum is soldered in Poland with ultrasonic vibrations instead of flux for breaking up the oxide layer on the work. Ultrasonic soldering has been employed in the US for some time (AM—Mar 12 '56, p258), but the Warsaw magazine, Przeglad Odlewnigtwa, says that the Poles think of it as **primarily a technique for reclaiming faulty aluminum castings.** They've developed a gun-type device that operates at 16 to 25 kilohertz with a self-contained magnetostrictive stack, heating coil, and rheostat.

FORMING . . . Impact-extruded gears that require no further machining have been produced by Heintz Mfg Div, Kelsey-Hayes Corp. Tolerances for the truck sun gear, formed integral with its shaft, are loose enough so that machining can be eliminated; tolerances for most automotive gears, however, are too tight for this technique. **This same impact-extrusion method has produced axles for trailers and torsion-bar anchors.**

CUTTING . . . Vibration analysis of machine tools can often pinpoint vibration trouble spots. For example, a centerless grinder required wheel dressing every twenty pieces. After analysis revealed that the drive motor was out of balance, **in-place balancing increased output per dress by 50%,** to 30 pieces. Details on p89.

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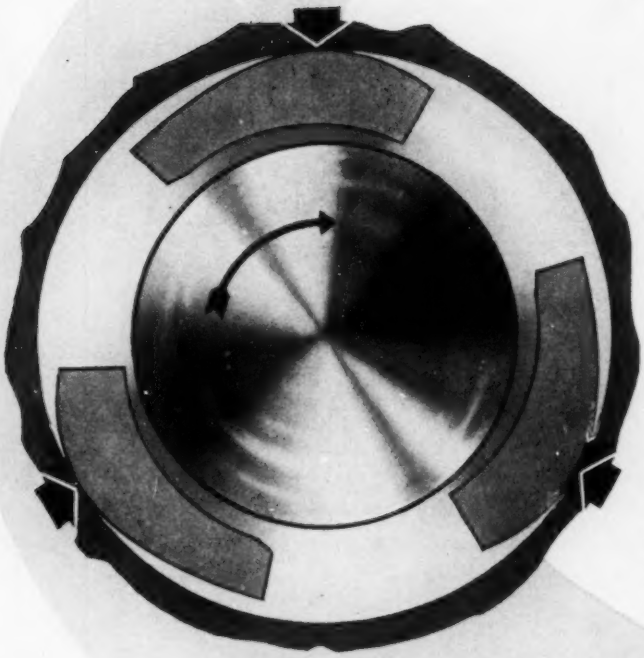

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Only CINCINNATI Grinding Machines offer you the many cost-reducing advantages of FILMATIC bearings. Turn the page to see one example of their amazing performance. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

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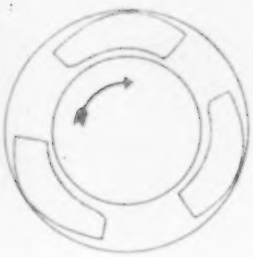

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At the right you see a rough, tough part subdued by Cincinnati's exclusive FILMATIC bearings. How these bearings promote rapid metal removal and low grinding costs is outlined on the preceding page.

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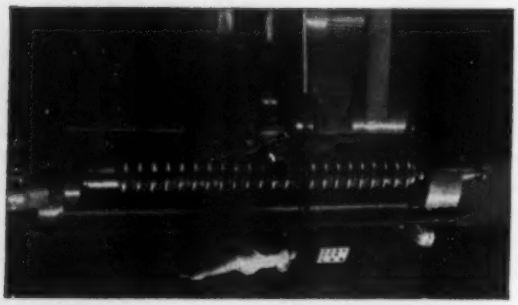

Tops in grinding heavy, hard stock and large work. It's easy for this new CINCINNATI FILMATIC 24" x 120" Plain Grinder. Catalog G-709-1.

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Photographs courtesy of Baker Perkins, Inc., Saginaw, Mich.

Huge savings in time are gained by replacing turning with grinding to remove hard, heavy stock on the OD of mixing screws. A CINCINNATI 24" x 120" Plain Grinder performs the operation, grinding the rough, interrupted surfaces to a high-quality finish.

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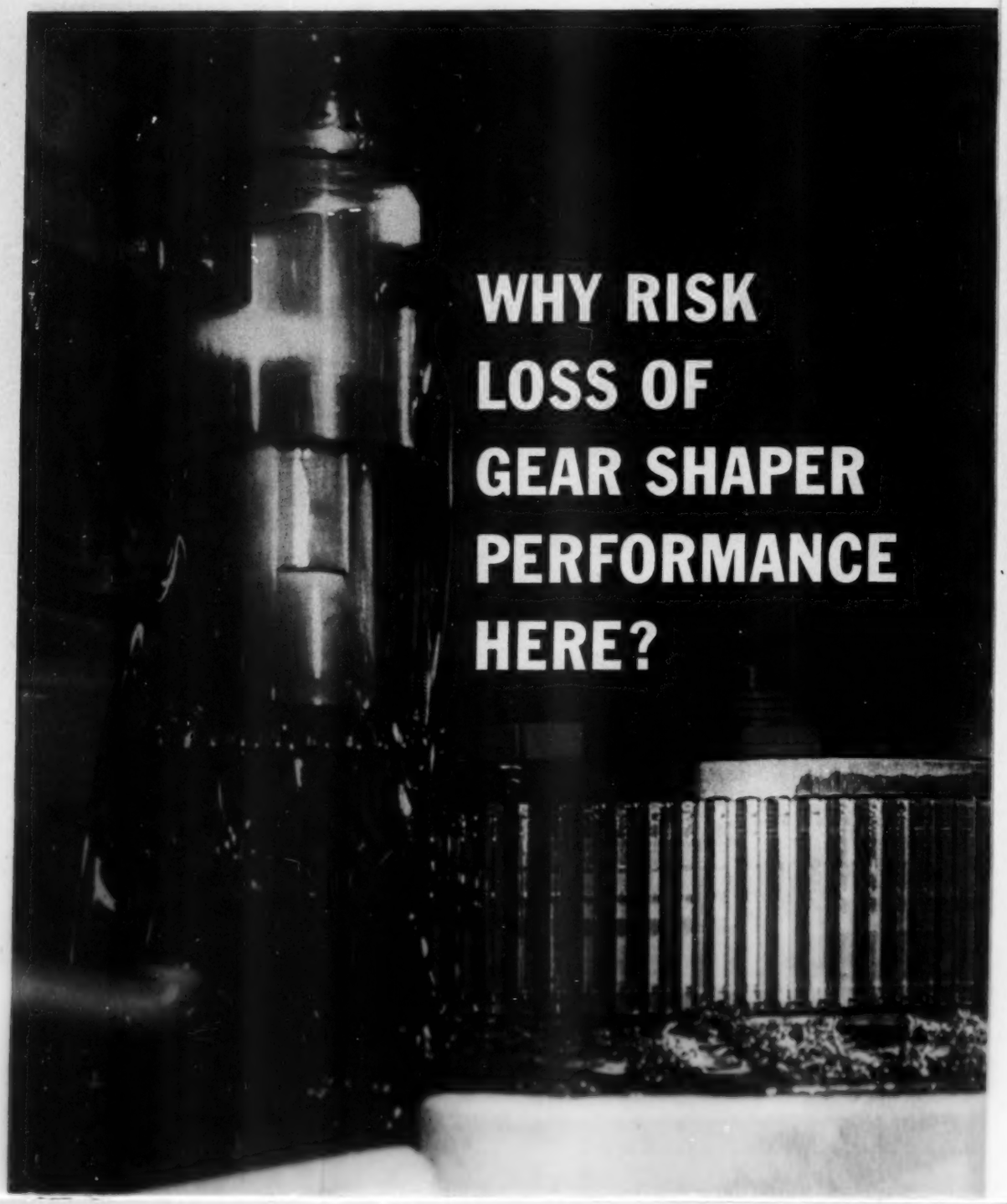

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extreme changes in stock removal

Among these advantages, most types of immunity save money. In precision grinding, the big money savers are FILMATIC spindle bearings . . . they are immune to extreme changes in rate of stock removal. CINCINNATI FILMATICS are the only grinding wheel spindle bearings of which this can be said . . . no manual adjustment required for any grinding load; no seizure or breakdown when the going gets tough; zero maintenance expense. Other advantages include:

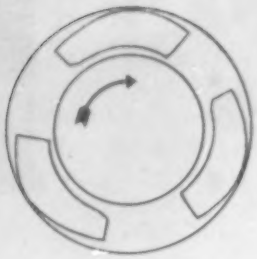
- Long trouble-free life, equal to the life of the machine.
- Quick spark-out, an important factor in rapid, accurate sizing.
- No "pecking" of the diamond while truing, resulting in smoother grinding wheel surface and the finest possible finish on the work.

These advantages are the result of Cincinnati's exclusive FILMATIC bearing design. Self-adjusting segments, submerged in filtered, circulating oil, produce independent wedge-shaped oil films which develop high radial pressures, maintaining dead-center rotation of the grinding wheel spindle.

Only CINCINNATI Grinding Machines offer you the many cost-reducing advantages of FILMATIC bearings. Turn the page to see one example of their amazing performance. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

PRECISION GRINDING MACHINES:
CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI
GRINDING MACHINE DIVISION



CINCINNATI

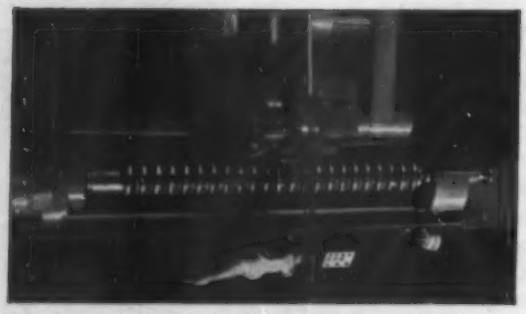
FILMATIC PLAIN GRINDER saves up to 35 hours

in grinding hard-surfaced mixing screw

At the right you see a rough, tough part subdued by Cincinnati's exclusive FILMATIC bearings. How these bearings promote rapid metal removal and low grinding costs is outlined on the preceding page.

The part is a 16″ diameter mixing screw, manufactured by a prominent builder of food and chemical machinery. The problem was to machine the OD of the flights to a smooth finish and at a reasonable cost. Formerly the part was turned on a lathe, requiring 35 to 45 hours. Too expensive. Now, the OD is *ground* in 10 to 15 hours! A CINCINNATI FILMATIC 24″ x 120″ Plain Grinding Machine performs the operation, reducing cost by more than half. And, finish is of a much higher quality than ever before.

All CINCINNATI Centertype Grinding Machines are built to remove metal rapidly and to the highest standards of quality. Generously proportioned structural elements are one plus factor. Another is the dependable pressure lubricating system for the ways. And, the FILMATIC bearing mounting for the grinding wheel spindle . . . no adjustment ever required for extreme variables in stock removal. More information on CINCINNATI FILMATIC Plain and Roll Grinding Machines in the heavy duty sizes may be obtained by writing for Catalog G-709-1.



Tops in grinding heavy, hard stock and large work. It's easy for this new CINCINNATI FILMATIC 24″ x 120″ Plain Grinder. Catalog G-709-1.

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CIRCLE 155 READER SERVICE CARD

Photographs courtesy of Baker Perkins, Inc., Saginaw, Mich.

Huge savings in time are gained by replacing turning with grinding to remove hard, heavy stock on the OD of mixing screws. A CINCINNATI 24" x 120" Plain Grinder performs the operation, grinding the rough, interrupted surfaces to a high-quality finish.

CINCINNATI

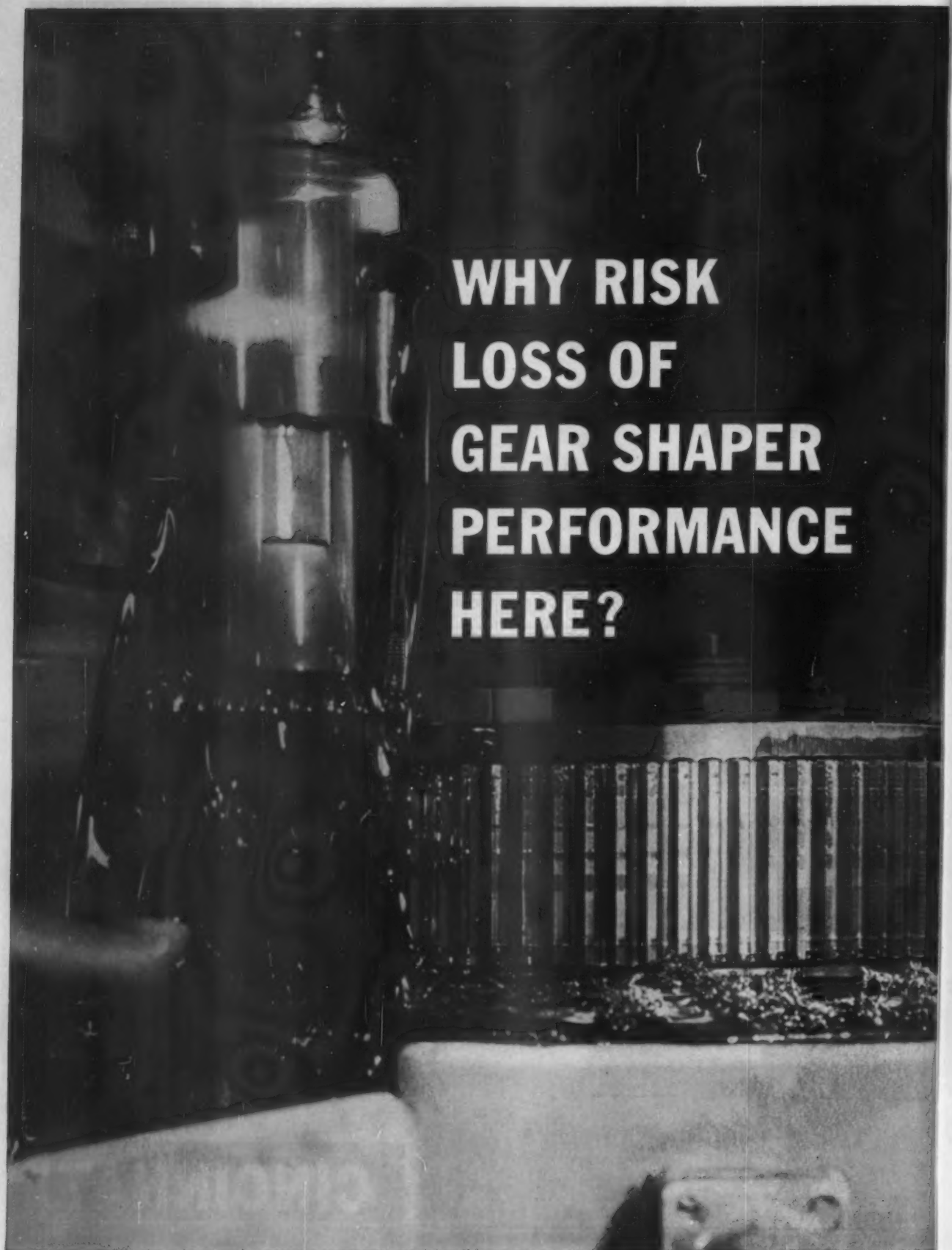
FILMATIC

• ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI®

GRINDING MACHINE DIVISION

CIRCLE 156 READER SERVICE CARD


WHY RISK
LOSS OF
GEAR SHAPER
PERFORMANCE
HERE?

Give your products all the high-production, high precision advantages of Fellows Gear Shaper performance by tooling up with Fellows cutters.

The better design of Fellows cutters is the result of advanced engineering techniques, including the use of a high-speed computer for solving design and application problems. Their better quality is the result of constant advances in metallurgy and manufacturing methods. And, proof of their better performance are the thousands of Fellows cutters in use on modern gear production lines.

Fellows cutters on Fellows machines lower costs and speed production on external and internal, spur and helical involute gears and a wide variety of non-involute shapes as well. All Fellows Offices are at your service for providing information.

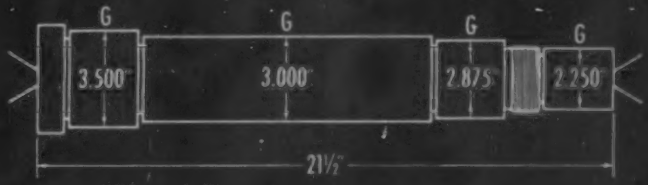
THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U.S.A.
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE **Fellows** *Gear Production Equipment*

Landis Size Finder cuts time

Landis 10" x 36" Type R Plain
with Size Finder and Microfeed®

60% grinding these 4 diameters



production data

Tolerance	± .0001"
Material	SAE 4140
Conventional grinding time	15 min. per shaft
Size Finder grinding time	6 min. per shaft
Time saved per shaft	9 minutes

size finder

For fast and accurate grinding of multiple diameter shafts to close tolerances, operator sets size finder dial indicator to required finish diameter. Microfeed advances wheelhead in fine increments after sparkout until finish size is shown on gage.

LANDIS

world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA.

CUTS MILLIONS OF FEET OF STEEL SQUARE and ACCURATE

Steelweld Shear Speeds Big Pipe Line Shearing

This shear cuts pipe line plate accurately. It has been doing so for years with only minimum maintenance.

Three completed pipes ready for shipment. Size: 35'-6" x 34" dia. x ⅜" wall. Weight each: 9,315 lbs. Part of an order for 24,500 feet.

Other typical pipe orders: (a) 600 feet of 72" dia. x ½" wall; (b) 15,500 ft. x 48" dia. x ⅜" wall. All plates used for these pipes cut on four sides by Steelweld Shear illustrated.

Dominion Bridge Company, Ltd., is the largest steel fabricating concern in Canada. Among its many activities is that of making steel pipe for Canadian pipe lines. At its Pacific Division, Vancouver, B. C., pipe is made in various diameters, mostly 3'-0" to 5'-0", and usually in lengths of 35'-0" to 40'-0". Pipe walls generally range from ¼" to ½".

One typical order called for 35 miles of 36" pipe in 40'-0" lengths with ¼" and 5/16" walls. This required 10,000 tons of steel. Five to seven plates were used for each pipe. Each plate was cut on all four sides to assure accuracy and squareness required for perfect fitting. Over a million feet of steel was sheared for this job — all on one Steelweld Shear.

The machine worked 15 hours a day, cutting 12,000 to 14,000 feet. The knives needed turning to a sharp corner every 2 to 2½ months, which meant that only after 8 to 10 months of continuous production shearing was regrinding necessary.

Heavy construction of the shear, Steelweld's own air-operated clutch, easy knife adjustment to suit metal thickness, and electric foot switch control, are some of the factors contributing to the success of Steelwelds on hard service jobs.

Write for Catalog No. 2011

STEELWELD

PIVOTED BLADE

Mechanical and Hydraulic

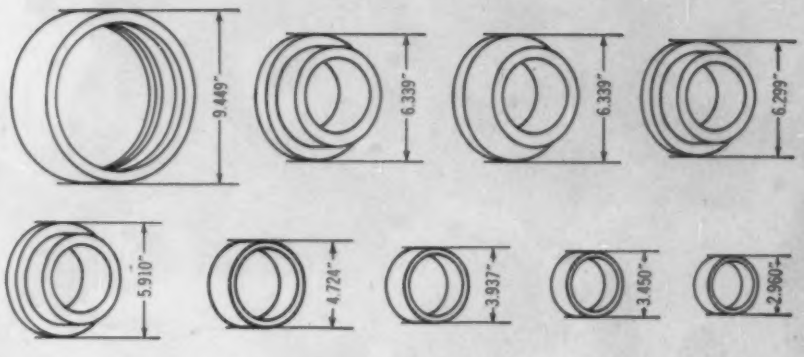
SHEARS

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 1463 E. 282 ST. • WICKLIFFE, OHIO

DISC GRINDS 9 DIFFERENT BEARING RACES

tooling on 2H30 handles bearing races from 9.4" to 2.9" diameter



Gardner 2H30 Precision Double Spindle Disc Grinder with feed thru fixturing.

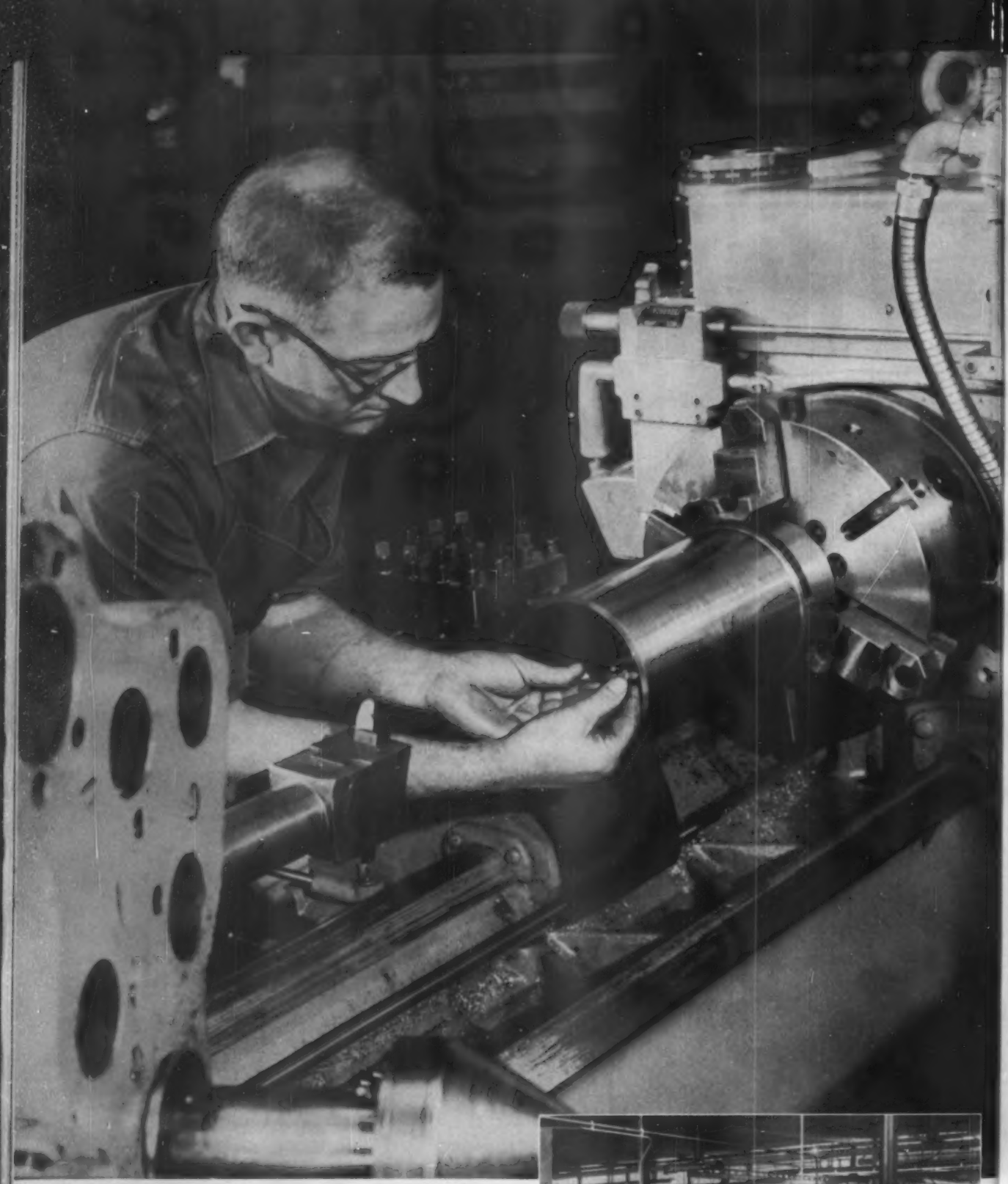
grinds **two** sides parallel in **one** operation

GARDNER

precision disc grinders

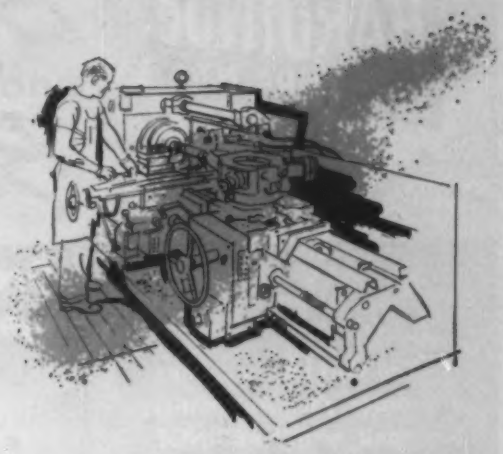
GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

a subsidiary of Landis Tool Company



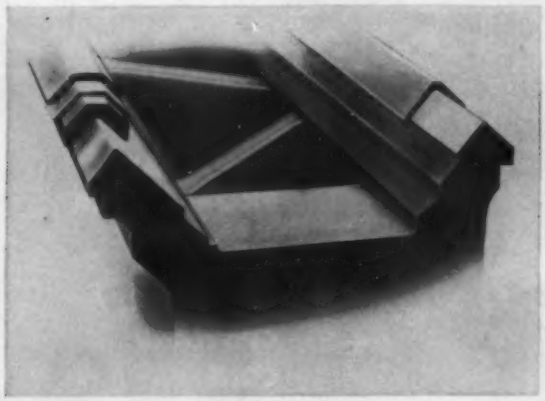
Canning Machinery Division's turret lathe department after modernization. Ten new machines like these replaced 14 old ones 16 to 19 years old. Result: labor costs dropped 50%; scrap loss down 65%; maintenance cut 70% plus many other benefits such as better operator morale. FMC found direct benefits became available from replacing all turret lathes at once, which are not ordinarily obtained with one-machine-at-a-time replacement.

AT CANNING MACHINERY DIVISION
Food Machinery and Chemical Corporation
Hoopeston, Illinois, Plant



2-A Turret Lathe bores stainless steel cylinders to .001" tolerance

Warner & Swasey 2-A Turret Lathe provides the necessary feeds and speeds, power and rigidity for handling critical jobs in tough work materials



Accurate Vee-Ways. Precision ground ways are induction hardened for long-term accuracy. Extra protection is provided by patented telescoping way-covers which prevent damage from heavy objects, scoring by grit and chip particles, and loss of lubrication on the ways from coolant splash.

Long cuts in tough materials to close limits of size and finish, see typical cylinder illustrated, pose no problem to Canning Machinery Division's battery of new Warner & Swasey turret lathes.

These machines have more and higher speeds, more power and precise optical alignment of the spindle with the precision ground self-guiding "Vee-ways". In addition, engineered placement of gibs, and distribution of weight through casting sections produce the ruggedness and rigidity needed for heavy roughing cuts in the same operation with the precision finishing cuts. As this company found, old equipment simply can't compete with the new Warner & Swasey's on the "problem jobs". For full information on the line of new Warner & Swasey turning equipment, why not contact the trained Field Engineer in your area. Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

HARDINGE
ELMIRA, N.Y.

TO GET *Better Performance* and *Better Production*

Greater Accuracy Quicker Set-Up
Longer Life Less Scrap Lower Cost

You start off right when you order your Automatics equipped with HARDINGE Style "S" Sure-Grip Master Collets and HARDINGE Style "B" Master Feed Fingers. Replaceable pads save up to 80% and performance is proved by years of use in thousands of screw machine departments.

For better performance at lower cost, standardize on HARDINGE Master Collets and Master Feed Fingers.

Style "S"
The Only Master Collet With No Work Pressure On The Screw

Style "B"
Pads Cannot Work Loose
No Screws — No Pins

AVAILABLE FROM STOCK
for
ACME-GRIDLEY
CLEVELAND
CONE
GREENLEE
GRIDLEY
NATIONAL ACME
NEW BRITAIN
WARNER & SWASEY

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Immediate stock delivery from Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia, Seattle, Portland, Minneapolis, Oakland, St. Louis, Springfield, N. J., and Toronto.

The VLIER new product BULLETIN BOARD

Brief descriptions of new VLIER products available now from your VLIER distributor!

NEW! Swivel Pad Torque Thumb Screws

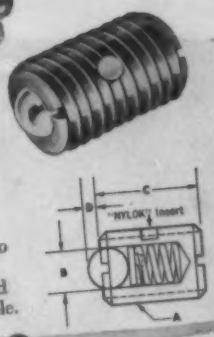
The perfect holding tool—combines torque-limiting feature of Vlier Torque Thumb Screws and the surface-protecting pad of Vlier Swivel Pad Clamps. Exclusive ball-joint construction. Available as standards in four sizes.

ITEM NO.	A	B	C	D	END PRESSURE IN POUNDS
TS-103	¼-20	2¼	5/16	⅜	12-14
TS-103-A	5/16-18	2¼	5/16	⅜	14-16
TS-104	⅜-16	2¼	5/16	⅜	16-18
TS-107	½-13	3	½	1⅛	18-20

National Coarse Thread Series Class #2A fit.

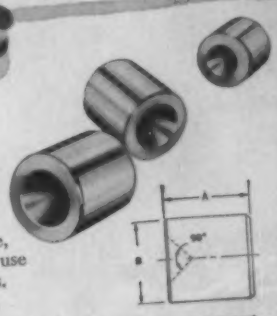
NEW! All Stainless Steel Ball Plungers

Available as standards in 10 sizes from 4-48 x 3/16" to ⅝-11 x 1"; standard end pressures. Special sizes and end pressures also available.



NEW! Hardened Ball Buttons

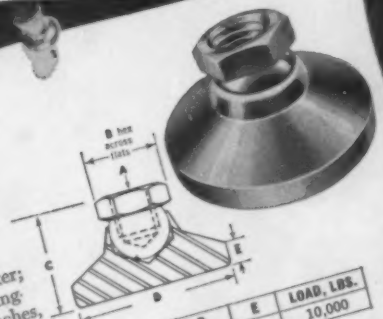
The perfect, ready-made, easy-to-install detent for use with Vlier Ball Plungers. Available in eight sizes.



ITEM NO.	FOR VLIER BALL PLUNGER NO.	A	B +.0002 −.0000
BB-46	B-46, B-47	1/16	.1075
BB-48	B-48	⅛	.1175
BB-50	B-50, B-52, BL-52, BH-52	3/16	.1614
BB-54	B-54, BL-54, BH-54	¼	.2034
BB-56	B-56, BL-56, BH-56	5/16	.2659
BB-58	B-58, BL-58, BH-58	⅜	.3284
BB-60	B-60, BL-60, BH-60	7/16	.4378
BB-62	B-62, BL-62, BH-62	½	.5472

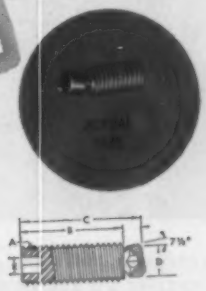
NEW! Leveling Pad

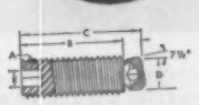
2½" in diameter; ideal for leveling machines, benches, electronic racks, etc.



ITEM NO.	A	B	C	D	E	LOAD, LBS.
P3088	⅜-11UNC-2B	⅜	1⅛	2½	5/16	10,000

NEW! A Miniature Socket-Set Swivel Pad Clamp... only 10-32 x ½"!





ITEM NO.	A	B	C	D	E	LOAD, LBS.
SC-324	Class 2 fit 10-32	11/32	⅛	.146	Hex 5/32	500

ask your distributor for complete information TODAY!

A "live" demonstration from Brown & Sharpe...

"Let me show you why Brown is the best height-setting

...Mr. Ermand Watelet, Director o

"Let's start with speed... You can set up three or four heights, in tenths, with your 10" or 20" Hite-Set® — faster than you can get out your "Jo"-Blocks!

"You see — Hite-Set has a series of half-inch precision blocks, locked in a carrier on one-inch centers. A super-accurate micrometer head moves the carrier up and down 1", and with the mike at 0.0000", the tops of the blocks are at even inches—1", 2", 3", etc., high.

"You just pick the right block — turn the head to your ten-thousandth reading. The top of the block is then at the height you want, ready for transfer. What could be quicker!

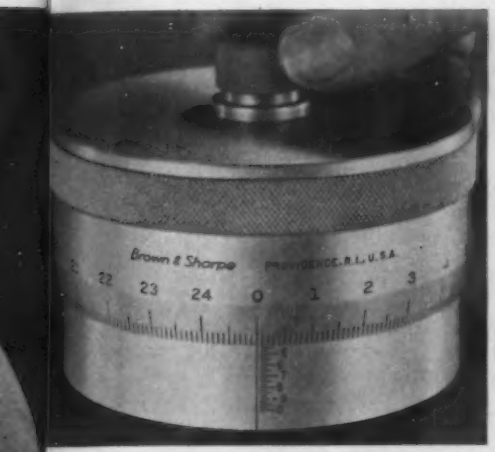
"Setting the bottom of blocks is easy, too, *without* attachments. You just subtract .5000".

"If you want even faster setting, there's Brown & Sharpe's 'Hite-Icator'. It's a Hite-Set with a dial indicator added that shows .1", .01" and .001".

CIRCLE 167 READER SERVICE CARD

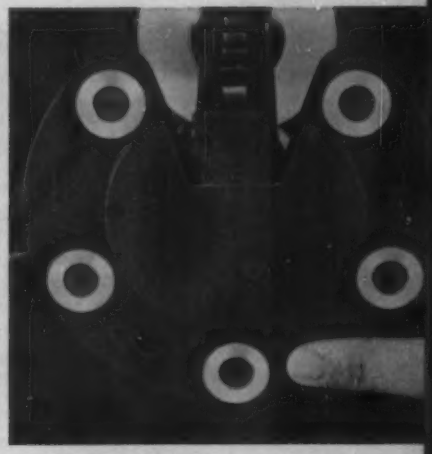
yn& Sharpe's new Hite-Set
ngtool you can buy!"

r Design, Brown & Sharpe, Industrial Products Division

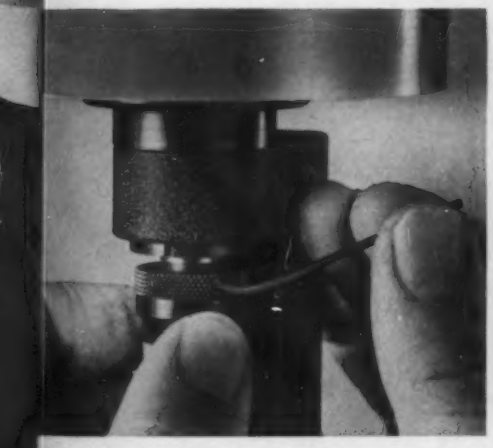


"Look at this easy-reading head! It's a full 4" across — the biggest in the business. Reads directly in tenths, and spreads the divisions out so you can see them all the way across a big surface plate or machine.

"See the accuracy you get — within .000050" over the entire range of blocks, and highly repeatable! You read off a small parallel surface, moving up and down, not, as in some tools, off a large rotating disk.



"Base is solid as a rock! These five big buttons are hardened and lapped to better than Class A Gage Block accuracy, so your Hite-Set won't tilt. (If it does, you need a new surface plate from Brown & Sharpe!)



"See the simple zero adjustment — You don't have to take the head off to set to "zero". Another feature: Repairs are economical; damaged Hite-Set blocks are replaced individually — you don't need a whole new column.

"Companion pieces to do any job better are available from Brown & Sharpe. Super Hite-Chek® (a) transfers heights in .000025". 9" Riser Blocks (b) extend range at low cost. B&S Black Granite plates and flats provide a perfect base.

"Finally, you pay less for Hite-Set accuracy. When the range of heights you want to measure is considered, you will find that combinations of Brown & Sharpe Hite-Sets and Riser Blocks usually cost less per inch of range than competitive tools."

Try Hite-Set, and you'll never settle for less! Ask your B&S distributor to show you this tool and the complete line of B&S inspection and gaging equipment. Brown & Sharpe Mfg. Company, Industrial Products Division, Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

CIRCLE 160 READER SERVICE CARD

Sectionized Transfer-matic Introduces New Concepts of Processing 4-Cylinder Blocks

A significant forward step in automation has been achieved by a new Cross Transfer-matic which integrates all operations except broaching that are required to finish cylinder blocks of three different horsepower capacities. The multiplicity of operations in a single machine and the fact that the entire line was created by one builder result in large reductions in engineering, materials handling, control circuitry and floor space.

The new Transfer-matic consists of six sections with a total of 121 stations. Three banking conveyors are provided between appropriate sections.

In Sections I and II, most of the heavy metal removing operations are handled. These include straddle milling the main bearings, milling the oil slinger grooves, rough drilling the valve lifter holes, rough boring the cylinders, rough boring the camshaft and milling the ends of the block.

In Section III, the sides are completely machined and the accessory and engine mounting pads are milled.

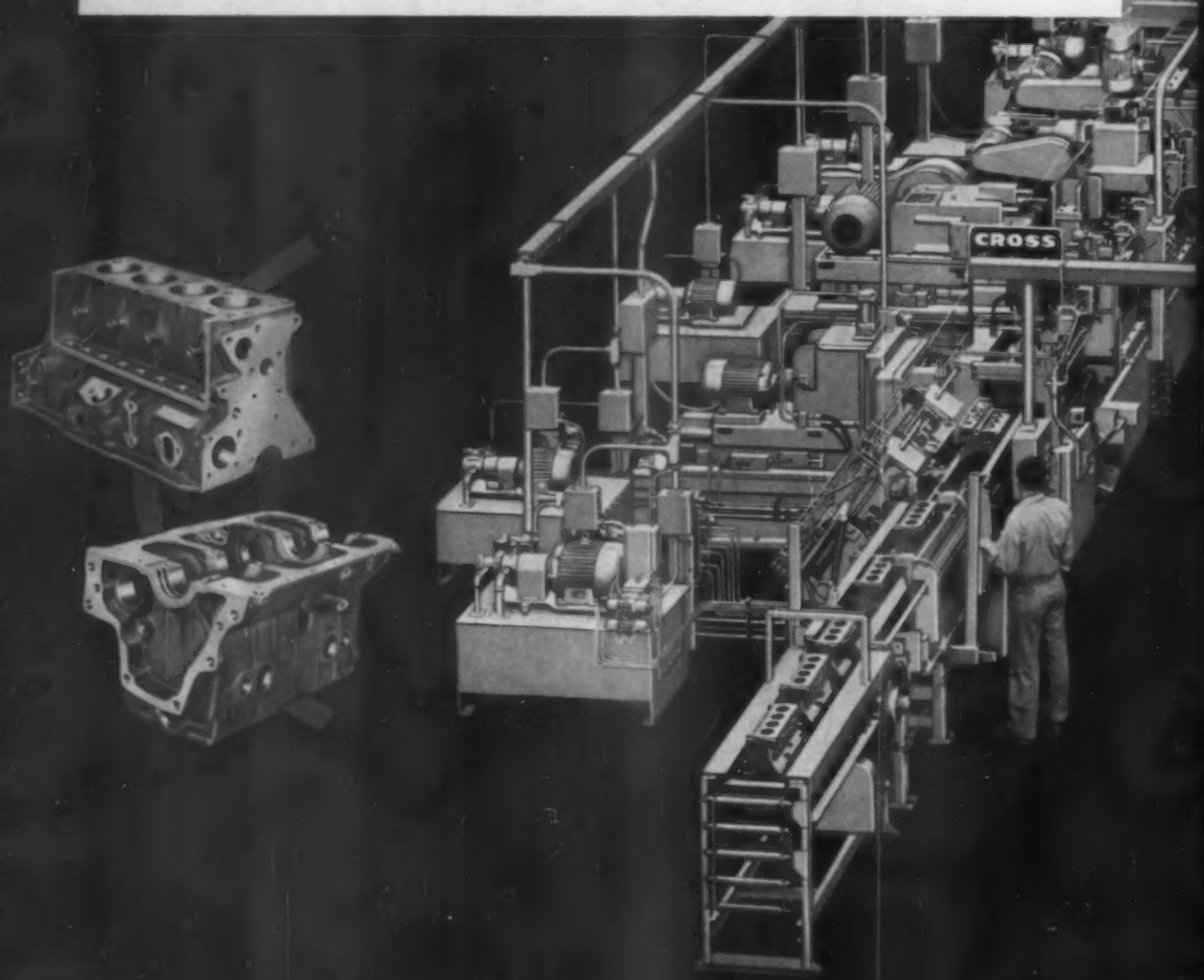
In Section IV, the operations on the top and bottom of the part are performed and the valve lifter holes are finish machined. A special coolant system is employed.

In Section V, the block is washed and the bearing caps are assembled.

In Section VI, the cam and crank boring operations and inspections are completed.

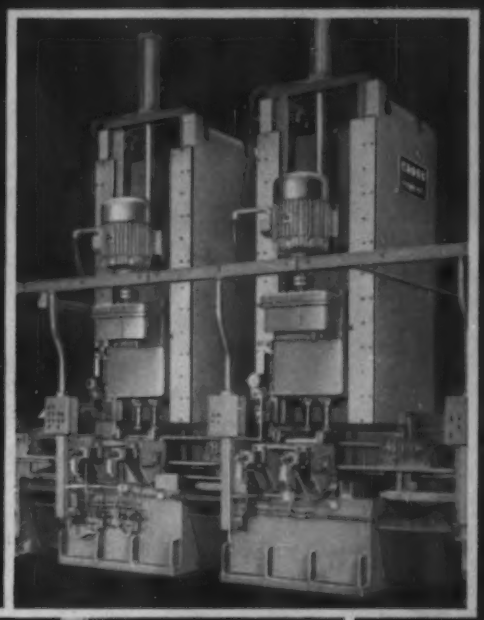
At 100% efficiency, production is at the rate of 109 blocks per hour.

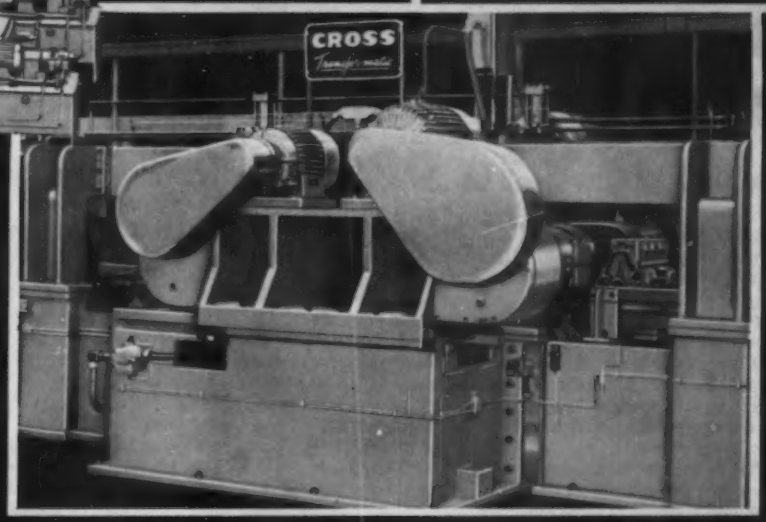
A Cross sales engineer would like to acquaint you with features of this Transfer-matic in detail.



Another Transfer-matic by Cross

Alternate cylinders are rough bored in adjacent stations.





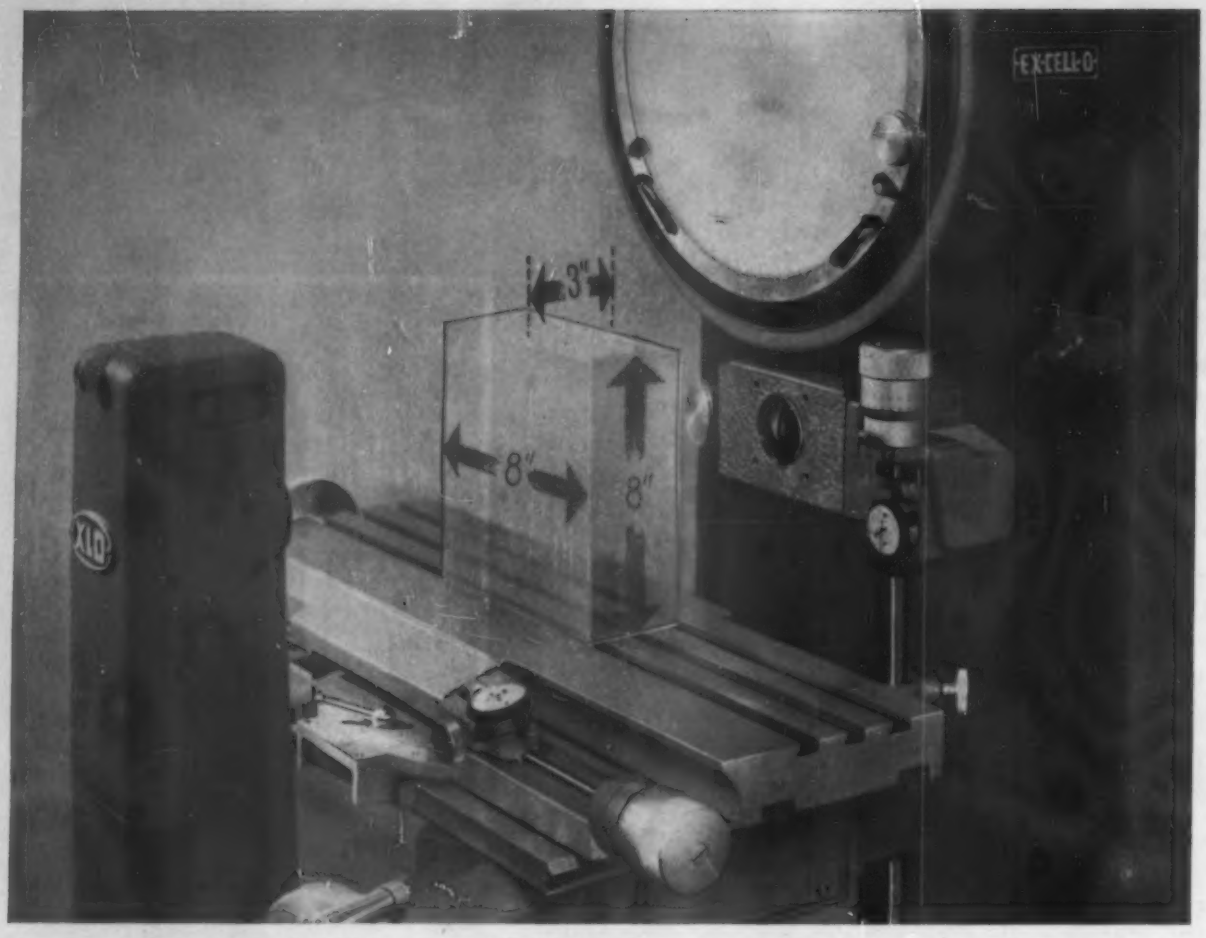
Rough and finish milling both ends of the block.

Established 1898

THE CROSS CO

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



EX-CELL-O Contour Projectors Give You 98% More Capacity

Ex-Cell-O Models 14-5 and 30 give you capacity to accept and optically gage much larger parts than is possible with other contour projectors,—*and without repositioning on the table!*

A full 8" of table travel in both horizontal and vertical planes, together with 3" of focusing travel is standard on these Ex-Cell-O Models. Every point within this "block" can easily be brought into focus on the screen.

Here is real capacity,—192 cubic inches,—98% *more* than the nearest standard model! Enables users to stage shafts 16" in diameter, (and larger in some cases), and 16½" in length on the standard work table with standard centers. Any point along the part contour can be optically gaged with convenient table movement.

"Cubage" isn't the only Ex-Cell-O capacity Plus! You get constant 8" of working distance (lens to focal plane) —20% more than other standard projectors. Full 8" of vertical measuring travel. Constant throat clearance, (collimator lens to front projection lens), of 17½" on the Model 14-5; 16" on the Model 30;—and Ex-Cell-O's rugged, heavy duty tables enable you to stage parts weighing up to several hundred pounds.

When you are ready to talk about Contour Projectors, compare feature for feature! There is an OGP Representative near you to demonstrate Ex-Cell-O's many PLUS values. Call or write. In the meantime, let us send you "43 Reasons Why EX-CELL-O Contour Projectors are the First Choice of Industry."

You Can Purchase Ex-Cell-O Contour Projectors on Conventional Terms . . . Deferred Payment Plan . . . or Lease With or Without Purchase Option. Select the Plan Best Suited to Your Needs.

Manufactured by EX-CELL-O Corporation at Detroit, Mich.

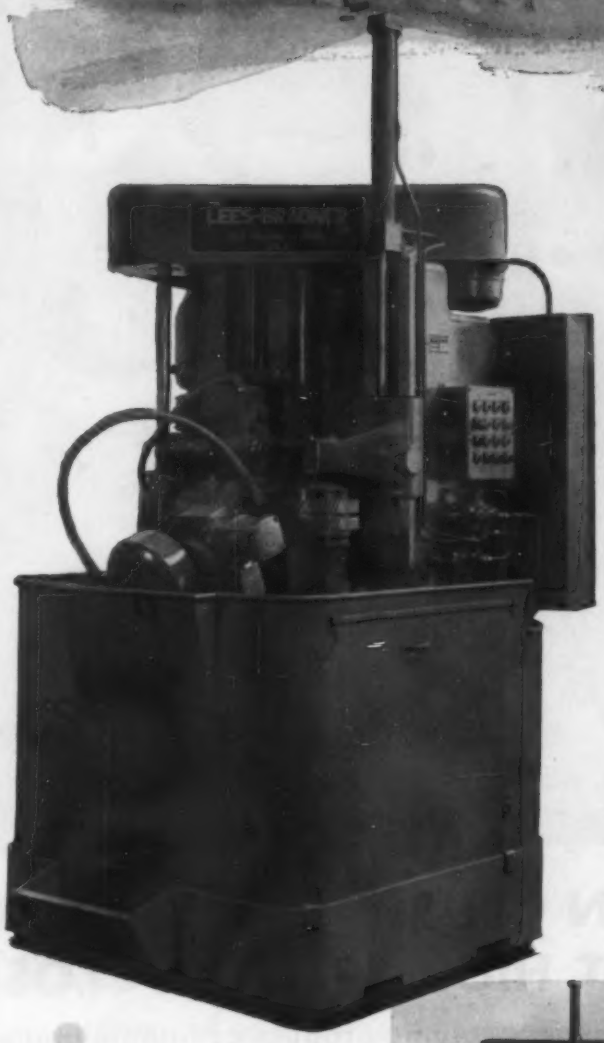
SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

26 FORBES STREET ROCHESTER 11, N. Y.

(A subsidiary of EX-CELL-O Corporation)

For Machines That Move Mountains...



GEARS

from the NEW 12-HD LEES-BRADNER

You asked for it and Lees-Bradner has built it . . . after years of design planning and months of building and testing.

This rugged hobbing machine — known as the 12-HD 12" x 20" — will produce gears up to 8, 9, 10, even 12 inches in diameter at mass production speeds. A revolutionary innovation is the new variable speed A.C. drive, using stock — *not special* — stock A.C. motors!

Now truck, tractor and earthmoving equipment manufacturers can generate heavy-duty gears as efficiently as smaller ones have been made.

Write Lees-Bradner for all the details — or get in touch with our representative in your area.

SPECIFICATIONS

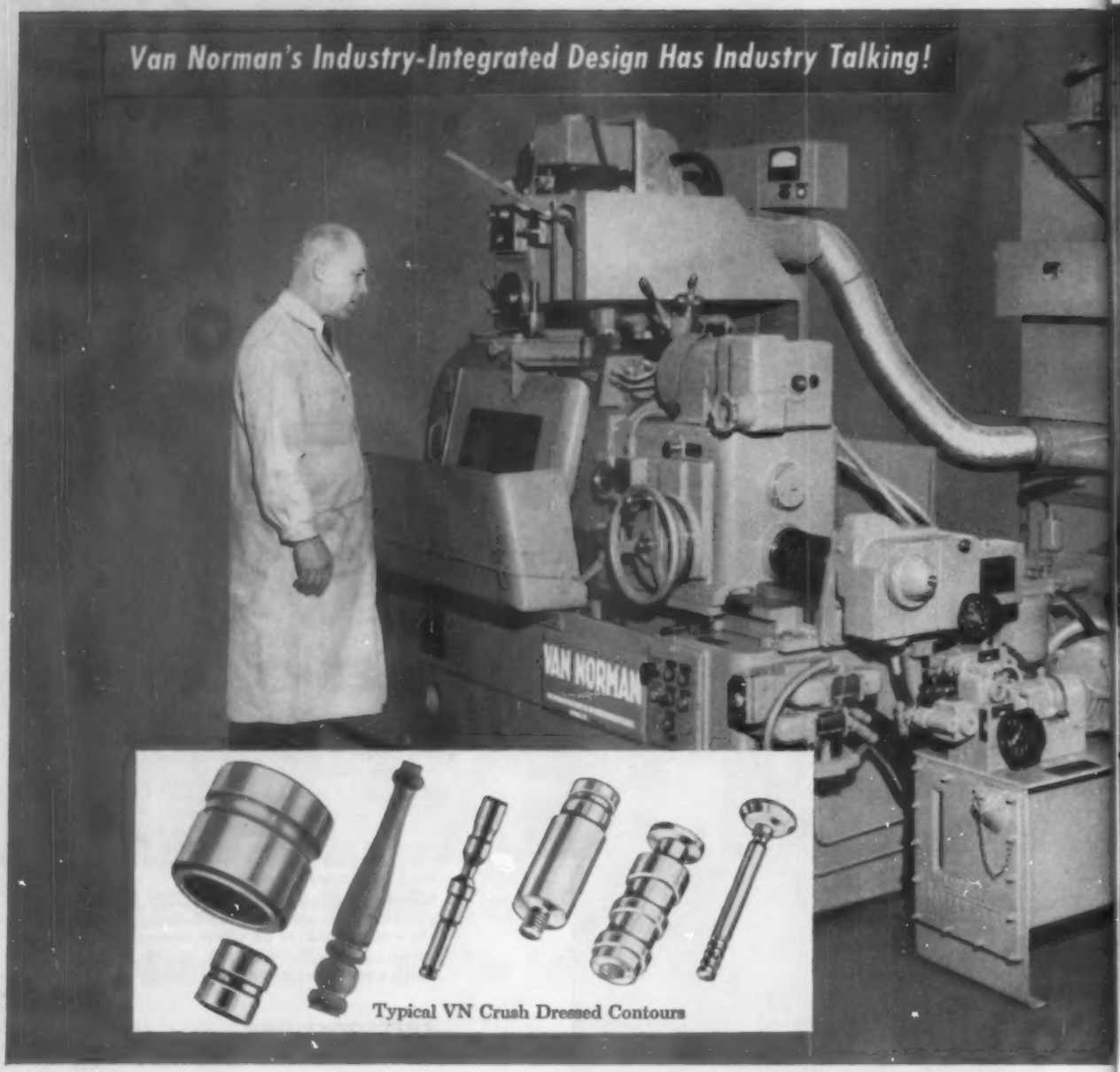
Rated capacity in steel	4 D.P.
Max. diameter capacity (with 5" hob)	12"
Max. helix angle	45°
Taper in work spindle nose	16 B & S
Floor space	60" x 60"

THE NEW 12" x 20" 12-HD
Designed to produce large, heavy-duty gears at high-production speeds.
Can be equipped with lead differential, electric hob shifter and hydraulic controls.

IMPROVING GEARS FOR 50 YEARS

the LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

Van Norman's Industry-Integrated Design Has Industry Talking!



Typical VN Crush Dressed Contours

VAN NORMAN CRUSH FORM GRINDS AT HIGH SPEED . . . CLOSE

VN Centerless Grinders volume-produce or handle limited

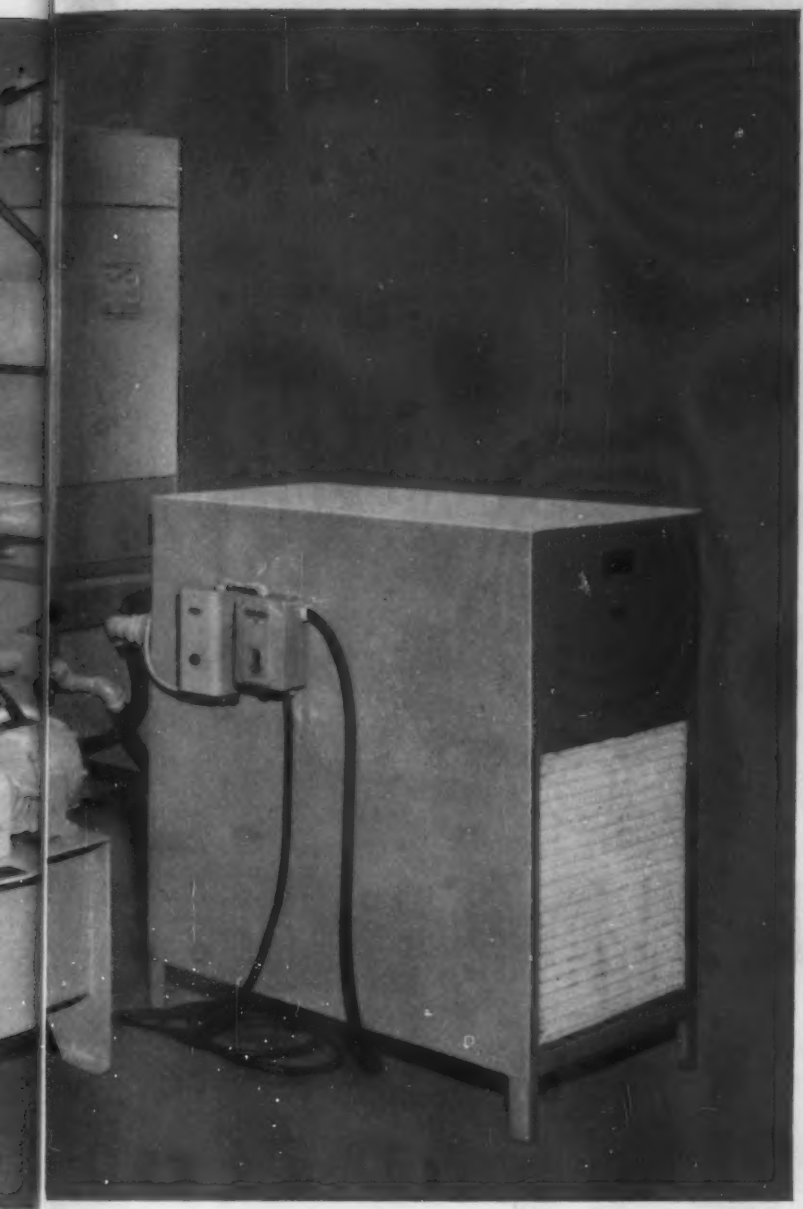
A Van Norman Centerless Grinder, with crush dress equipment, will grind intricate shapes and volume-produce many parts previously thought impossible.

Faster Output To Close Tolerances—typical of the high-speed, close-tolerance operations performed by Van Norman is the largest crush formed part shown above. A crush formed wheel grinds the O.D. and ball race simultaneously, holding .005 radius on the corner of the ball race, .001 tolerance on race curvature and .0005 tolerance on the O.D. and diameter of the ball race, with 10-12 RMS finish.

This part is ground in one operation, after a Thru-Feed grind on O.D. In the finish grind operation the O.D. and ball race are ground simultaneously to insure concen-

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS



MANY PARTS TOLERANCES

runs with equal versatility . . . economy

tricity. Stock removal .004; Infeed cycle 12 seconds. Result: five parts are finished per minute, 300 per hour.

Free Booklet—"Centerless Grinding"—valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.

A134

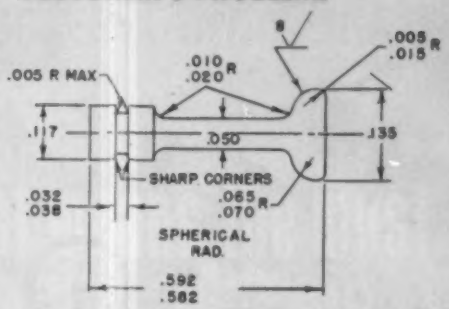
MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

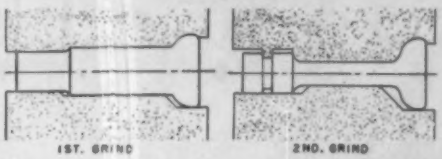
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



To produce at the lowest possible cost this small nozzle valve used in the manufacture of fuel injectors. Present method used was to rough turn part on screw machine, harden, then finish grind in 5 different operations at very high cost. The material is high speed steel hardened to Rockwell 58-62 "C" scale. An R.M.S. finish of better than 10 required.

VAN NORMAN SOLUTION:



By using the Van Norman crush forming method the part is ground from a hardened blank in three operations and all tolerances held as specified. (1) In the first operation the part was roughed as shown in sketch, forming both the regulating and grinding wheel to shape shown to give the part full support during grinding operation. (2) In the 2nd operation the narrow groove as well as the long diameter in the center and the .010/.020 radii was finish ground. (3) In the last operation the diameter was finish ground to assure sharp corners called for and also finish valve radius .065/.070 to finish size and finish of 8 R.M.S.

THE RESULT:

The three operations were accomplished in record time. 1st operation—180 pieces per hour at 100%. 2nd operation—150 pieces per hour at 100%. 3rd operation—180 pieces per hour. Cost savings over old method were tremendous. Actual figures on old method are not accurate but savings amounted to over 400%.

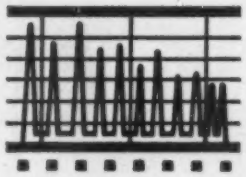
IF you want to control

and improve the quality of your product

with measurements displayed

on a dial . . . in an air column

or in signal lights

on a panel or a chart 

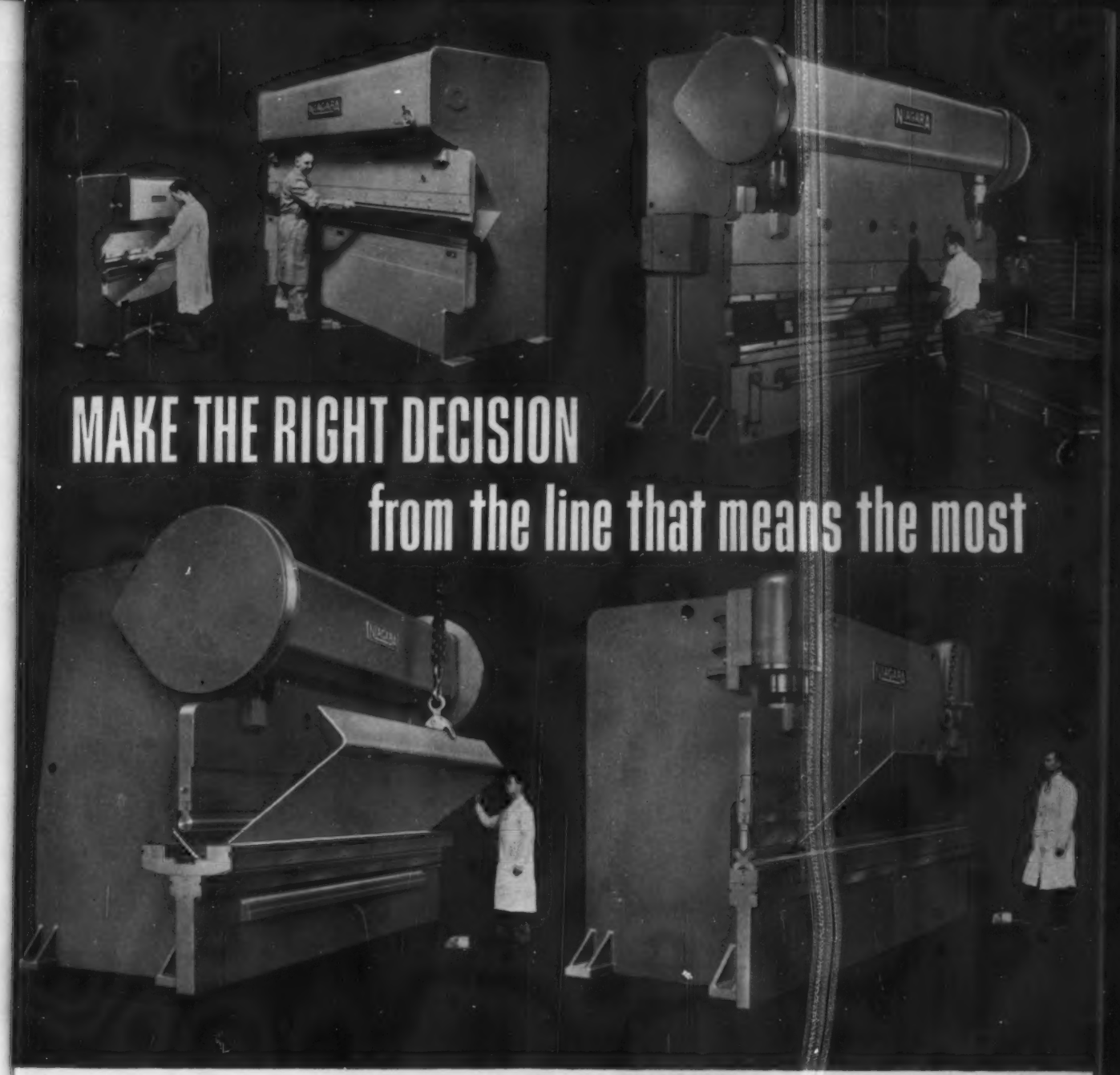
there'll be no IF in the results

when you measure with Sheffield gages

The SHEFFIELD Corporation Dayton 1, Ohio

A subsidiary of The Bendix Corporation

Inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.



MAKE THE RIGHT DECISION
from the line that means the most

With men who know their press brakes, Niagara means the most. Mechanical or hydraulic, there's a tremendous choice of sizes and bending capacities in a 15-1000 ton range. From 121 models, you're sure to make the right press brake decision.

Yes, you'll find it pays to talk "press brakes" with Niagara . . . for here you'll be talking with press brake people who not only build them all, but take pride in building them *best of all.*

Niagara can be your die headquarters too. "Standards" in stock . . . "specials" to order.

You're invited to check the Niagara Press Brake story . . . in fullest detail. Write for these illustrated bulletins.

15, 30, 60 ton — Mechanical	Bulletin 90
90 thru 1000 ton — Mechanical	Bulletin 89
200 thru 1000 ton — Hydraulic	Bulletin 91
Dies	Bulletin 92

NIAGARA

PRESS BRAKES
mechanical and hydraulic

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.
District Offices and Distributors everywhere.

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

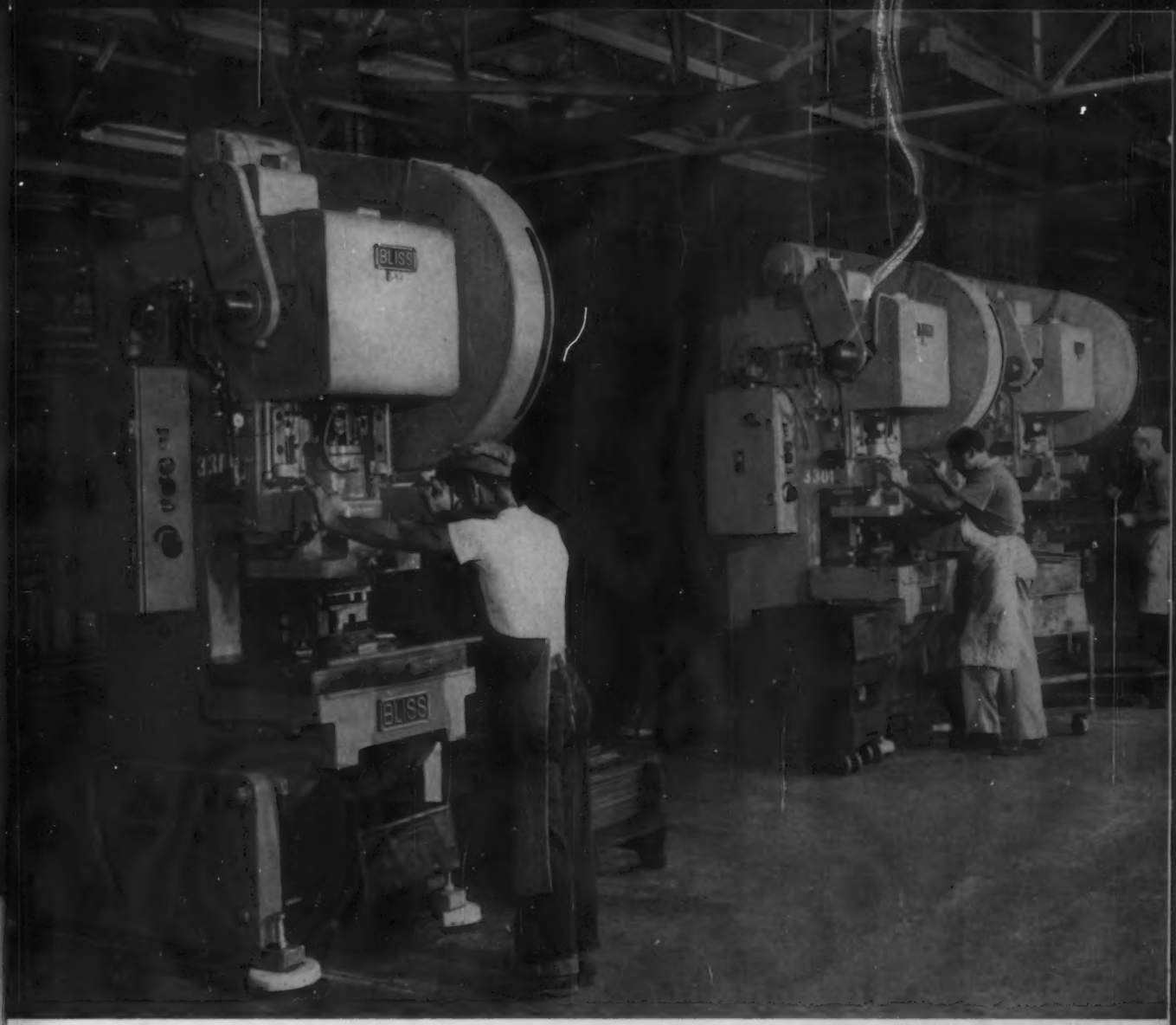
CIRCLE 176 READER SERVICE CARD

Only this label can assure you of AIR EXPRESS priority service

Let's clear up a frequent misunderstanding: AIR EXPRESS is not a general term for all air cargo. It's a specific air-ground shipping service: AIR EXPRESS Division of R E A Express. Many businessmen learn this the hard way. They assume that the famous AIR EXPRESS advantages of jet speed and door-to-door service apply to all air shipping companies. It just isn't so. There's only one way to be sure your shipment is first on, first off, first there—via all 35 scheduled U. S. airlines. Or gets kid-glove handling throughout the U. S. and Canada. And that's to be sure it gets this label. If it doesn't . . . it's not AIR EXPRESS.

AIR EXPRESS

CALL AIR EXPRESS DIVISION OF R E A EXPRESS • GETS THERE FIRST VIA U. S. SCHEDULED AIRLINES



New Bliss inclinables take front seat at American Seating

Shown here are three of four new Bliss C-60 inclinable presses recently installed at American Seating Company, Grand Rapids, Mich. All four presses get day-in, day-out use in a variety of operations . . . they blank, draw, pierce, perforate, punch, trim, form and notch many types and sizes of sheet metal parts that American Seating, world's largest producer of fine institutional furniture, uses in its lines of chairs, desks and other furniture. The new "C" inclinables, with their extremely rugged frames, large bed area and long stroke adjustment, are well-suited for this general-purpose service, with its frequent die changes and strenuous single-tripping. All presses are non-geared and equipped with the Bliss CK crankshaft-mounted air-friction clutch and brake.

If you would like details of Bliss' new "C" inclinables, we will be glad to send you a free copy of our Bulletin 2F. Illustrated in color, it is yours for the asking. Or, if you prefer, our local representative will be happy to give you complete information.

BLISS
SINCE 1857

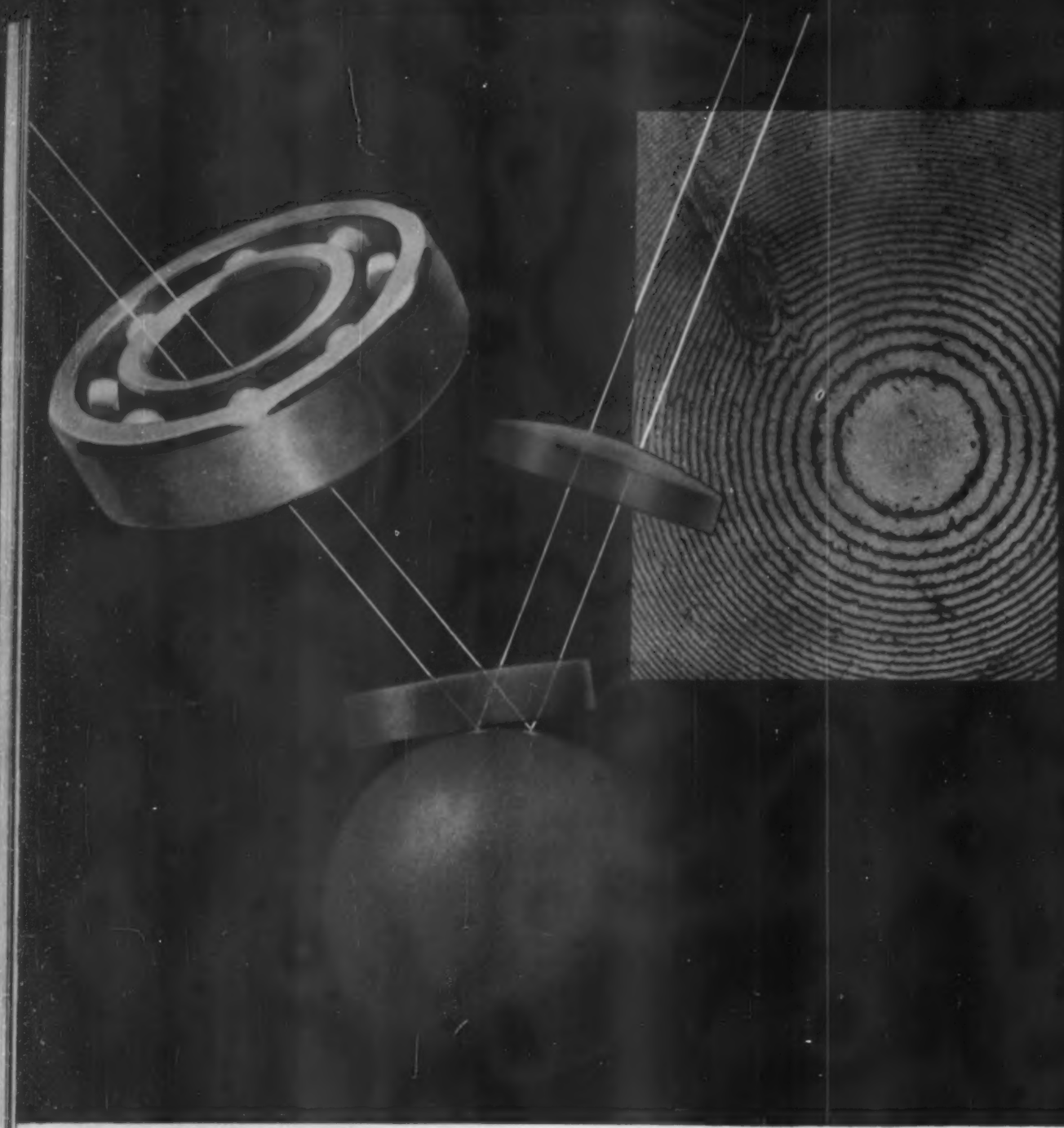
BLISS is more than a name—it's a guarantee

E. W. BLISS COMPANY · Hastings, Michigan

Foreign Subsidiaries: E. W. Bliss (Canada) Ltd., E. W. Bliss (England) Ltd.
E. W. Bliss Co. (Paris) France, E. W. Bliss-Henschel G.M.B.H., Dusseldorf, West Germany

PRESSES · ROLLING MILLS · ROLLS · DIE SETS · CONTAINER MACHINERY · CONTRACT MFG. · PUBLIC SAFETY

CIRCLE 178 READER SERVICE CARD



SPLIT LIGHT BEAMS MEASURE IN MILLIONTHS

to help SKF build better bearings

SKF MOTION ENGINEERING

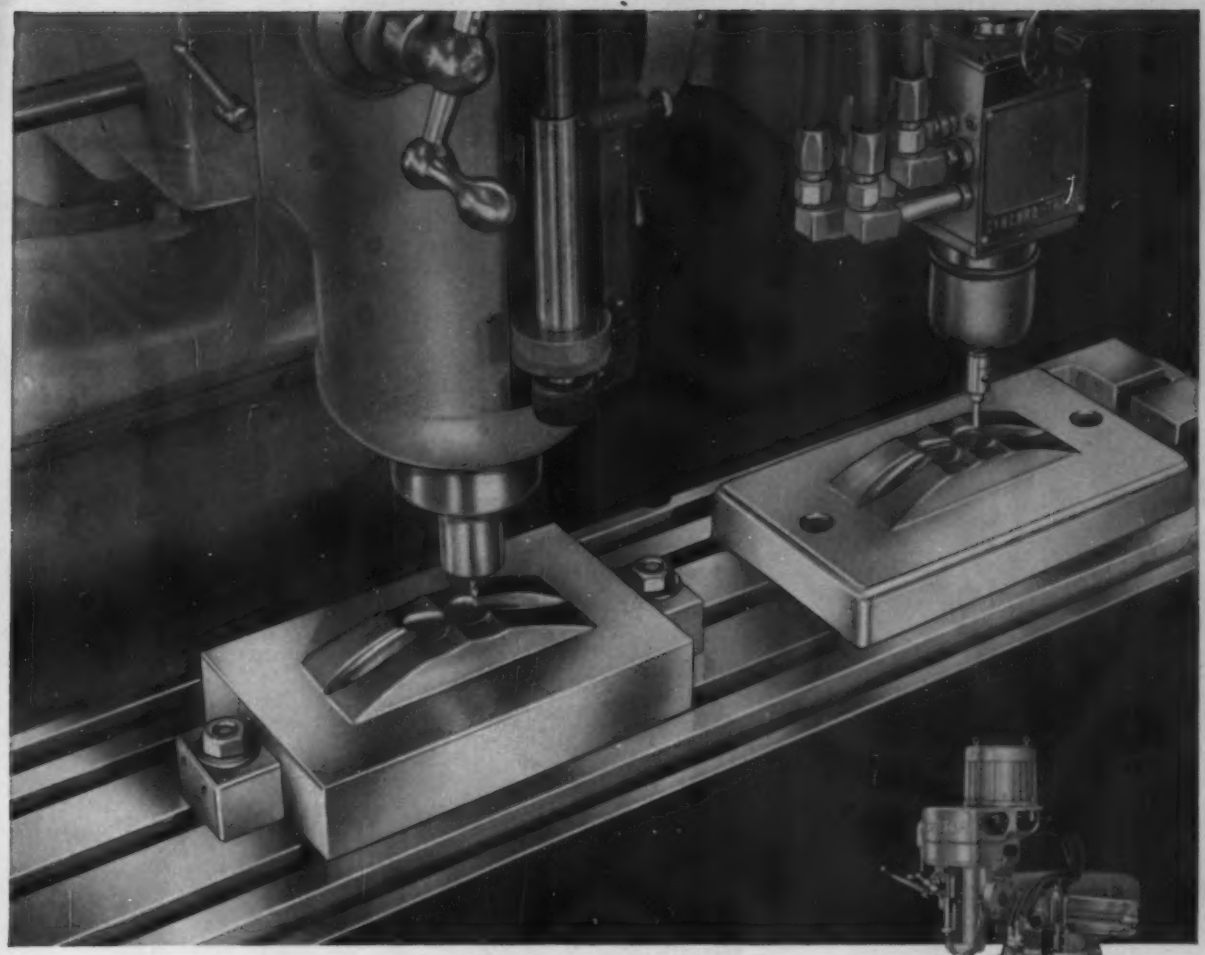
Advanced ball and roller bearing technology

The concentric pattern of interference fringes in the picture above is reproduced from an actual photo taken with the aid of an interferometer in the SKF laboratories. The subject under examination is a microscopic flaw in the surface of an accurately lapped steel ball. The principle of utilizing split beams of light to form interference patterns enables accurate measurements to be made in *millionths* of an inch.

SKF is a leader in the development and application of ultra-precise measuring systems. The SKF metrology laboratory plays an important part in a continuing program of research to produce bearings of improved accuracy and finish, and consequently, quieter, smoother running characteristics.

Whatever types of rolling contact bearings you need—ball, cylindrical roller, spherical roller, tapered roller or precision miniature—you'll find SKF your best assurance of dependable performance. SKF Industries Inc., Philadelphia 32, Pa. 6104

CIRCLE 179 READER SERVICE CARD

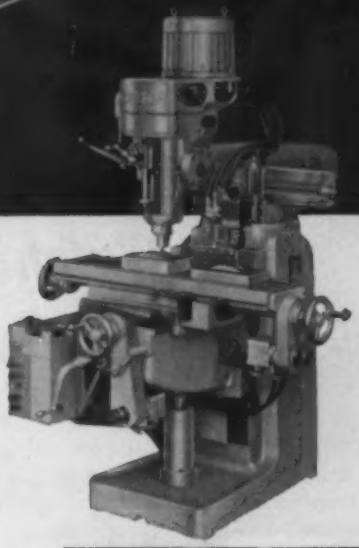


NEW AUTOMATIC DUPLICATOR

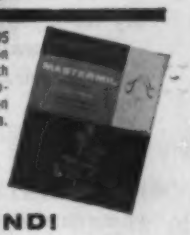
GORTON

Synchro-Trace Mastermil

Now . . . in response to metal-working needs, Gorton presents a fully automatic rise and fall duplicator, ideal for all types of dies and molds in ferrous and non-ferrous materials. Sensitivity and accuracy are combined in this rugged milling machine with versatility for power feed and hand feed milling operations . . . a duplicator to provide you with the simplest, fastest, most accurate way to make dies and molds.



Write for Bulletin 3095 for full particulars on Gorton Mastermil with Integrated Synchro-Trace or Contact Gorton Distrbutor in your area.



A GORTON PRODUCT, THE FINEST OF ITS KIND!

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1504 RACINE STREET RACINE, WISCONSIN

Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories. Defense and special products.

He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy". . . accuracy, being held to within a few thousandths of being perfectly straight, and he can actually *see* the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2" to 18" in diameter, this MARVEL #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective electro-mechanical servo-mechanism that continuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SURE-LINE" unit literally "steers" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SURE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Production Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. *Write for catalog today.*

ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL Metal Cutting SAWS
Better Machines · Better Blades

Around and Around They Go

Here on a Cross dial machine in a plant of a large manufacturer of steering equipment, are two GEOMETRIC Solid Adjustable SJ Taps equipped with CARBIDE CHASERS and rotary pilots.

Two by two, malleable iron Power Steering Housings arrive under the taps, acquire their 2¼ - 20 Class 3B threads and pass on in a matter of seconds.

Carbide Chasers have given such unparalleled dependability on this job that they are now standard on many GEOMETRIC installations in the plant.

Call your Distributor for an appointment with a GEOMETRIC Chaser expert.

INDUSTRIAL DISTRIBUTOR
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GEOMETRIC TOOL COMPANY
NEW HAVEN 15, CONNECTICUT

"Molded Horsepower" to fit your machine tool

...no longer must you "make something do!"

Just as a famous artist molds each illustration to his need... so, too, can you now have a machine tool motor designed for machine tool use. Not just another line of motors that can be "made to fit," but a complete new type developed, by Reuland, exclusively for machine tool manufacturers.

Reuland "Molded Horsepower" offers a combination of advantages never before available. Dynamic balancing, low inertia rotors, heavy duty ball bearings straddling the rotor, compact "wafer" design, smooth finished castings, baked enamel finishes... even pleasing lines that can be varied to fit the contour of *your* machine!

No wonder Reuland is "number one" supplier to many of the top names in the machine tool field!

Reuland Precision Machine Tool Motors are available in totally enclosed non-ventilated or fan cooled types – ratings from ½ h.p. through 15 h.p. Also available as a machine tool *brakemotor*, incorporating both motor and Reuland magnetic brake in a single frame.

Our new 8-page catalog, No. GS8-30-0, will come in handy. Sent complete with prices and engineering drawings on request.

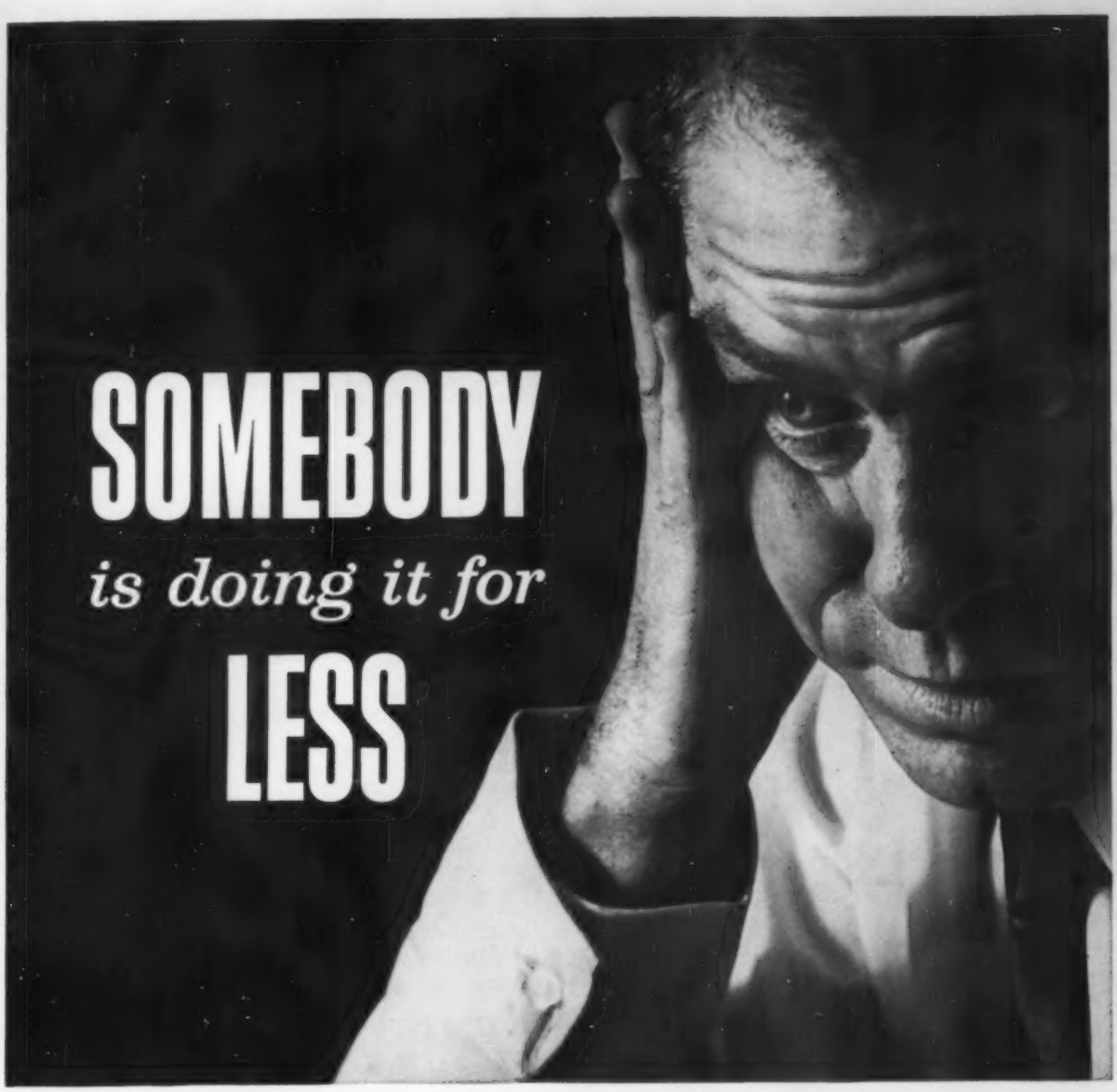
MODERN POWER FOR MODERN-DAY PRODUCTS

...all in lightweight, cool-running aluminum frames!

REULAND MOTORS

Refer to Sweet's Product Design, Section 7a-RE

REULAND ELECTRIC COMPANY
WESTERN DIVISION: *Alhambra, Calif.*
EASTERN DIVISION: *Howell, Mich.*
Distributors in all principal cities



MASTERLINE® 51B SUPERFINISHER

Newest in the line—for parts not requiring traverse of the Superfinishing stone. A longitudinally adjustable platen supports a reciprocating unit holding one or two stone-carrying quills. Add a second platen and you can handle up to four diameters at once—automatically.

A similar **Model, 52A** offers longitudinal stone traverse. You can select from a complete line of general-purpose and high-production machines and attachments. Call your Gisholt Representative or write for Catalog 1159-C.

Are you giving your competitors a decisive edge by using outdated surface-finishing methods?

If you need a controlled finish (1 micro-inch RMS to 80) on cylindrical, tapered, flat or spherical surfaces, Superfinishing will cut your costs and improve quality.

In many cases you can Superfinish® direct from a turned surface and eliminate grinding. On other parts you rough-grind, then Superfinish. Your finish is produced in seconds, *automatically*, piece after piece!

You save on initial investment, grinding-wheel costs, production time, work-handling, and floor space. With optional "size control" you can even eliminate final inspection.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

◄ CIRCLE 183 READER SERVICE CARD

CIRCLE 184 READER SERVICE CARD

Open house at a New England machine tool plant—Photo by Ted Croner

Open house for machine tools

...and a word about the part commercial banking plays in one of America's most important industries

When the townspeople come to call they get a pretty good idea of what makes a machine tool tick and ultimately turn out products as diverse as mechanical toys and massive earth movers.

But one thing visitors can't see or hear where the big robots of industry turn and pound is the money that keeps them moving.

Most often it comes from commercial banks.

Loans from banks help provide manufacturers with the working capital necessary to design and build complex and costly machine tools. Loans frequently help pay for plant expansion and modernization. And bank loans supply much of the ready cash American industry requires to purchase and install machine tools.

The Chase Manhattan Bank, first in loans to business and industry, is proud to present this tribute to machine tools, a competitive industry whose products ultimately provide a variety of consumer goods which help all Americans exercise their basic right to pick and choose.

THE CHASE MANHATTAN BANK

CHARTERED IN 1799

I Chase Manhattan Plaza, New York 15, New York

Member Federal Deposit Insurance Corporation

CIRCLE 185 READER SERVICE CARD

CIRCLE 186 READER SERVICE CARD ►

NEW *from* NORTON

Test
23 ALUNDUM* abrasive
for premium performance at non-premium price . . . on your production!

The newest Norton development for production grinding is for production economy, too.

It's 23 ALUNDUM abrasive.

This is no ordinary aluminum oxide. Except for price — which is *non*-premium — 23 ALUNDUM abrasive is *premium* in every respect. It has premium toughness . . . premium sharpness . . . and free, fast, cool cutting action that means premium precision performance.

Other big advantages are friability, which minimizes dressing . . . precise duplication, which assures uniform performance . . . and versatility that includes grinding of all steels, boiler plate, cast iron, Meehanite, aluminum and many other widely varying metals.

All of which adds up to the proved premium value of 23 ALUNDUM abrasive — in the broadest range of production grinding. For example:

Surface Grinding. With the new 23 ALUNDUM segments and cylinders, users are getting freer cutting and higher production rate on large die blocks, high vanadium steel tool bits, attrition plates, high carbon steel knives, stamped metal parts and similar work.

Centerless Grinding. Excellent results on bar stock grinding for automotive parts of carbon and stainless steels, cast iron and other metals, hard and soft.

Cylindrical Grinding. Top quality, low cost volume production of high speed steel drills, reamers and taps, laminated armatures, cams, shafts, sleeves and valve stems.

Internal Grinding. Bearing races and bores, precision ground faster to tight limits and fine finish, with less wheel dressing. Reduced grinding costs on cylinder bushings, die holes, rocker arms and wrist pins.

That's just a brief outline of 23 ALUNDUM abrasive's advantages for production grinding.

You can *see* them in action, right in your own plant — you can watch 23 ALUNDUM wheels or segments adding new speed, accuracy and economy to your own production grinding.

Your Norton Distributor or your Norton Man will be glad to arrange a test run in your plant, with expert aid in wheel selection. See him soon. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

W-2007

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

NEW 20" CLAUSING HEAVY-DUTY DRILL PRESS

POSITIVE-POWER VARIABLE or STEP PULLEY 5 or 10 SPEED

COUNTERSHAFT DRIVES

20" variable drive drill with 1 HP motor, switch. *Ready-to-run* — only $508.00. Order No. 2271

- ***SPEED RANGES — 150 to 2000 RPM***
  Dial speeds with variable drive model.
- ***PRODUCTION RATED CAPACITIES***
  Dia. hole in cast iron.....1⅛"
  Dia. hole in steel.....⅞"
- ***GEAR DRIVEN POWER FEED or HAND FEED***
- ***MACHINED and BALANCED PULLEYS***
- ***19½" x 22" PRECISION GROUND TABLE — 4" COLUMN with ½" WALL — MASSIVE, GROUND BASE***
- ***READY-TO-RUN — MOTOR and SWITCH INSTALLED — WIRED — FACTORY TESTED***

Clausing drills out-perform — on continuous production, in the tool room, maintenance shop — every application — because they are built better. Ask your dealer to prove it! And write for literature on the new 20" and 15" models.

362

CLAUSING
DIVISION OF
ATLAS PRESS COMPANY

OUTSTANDING VALUES IN PRECISION MACHINES

4-102 N. PITCHER STREET, KALAMAZOO, MICHIGAN

ACCURACY AND GRIP...

When you buy new tools or rebuild old ones

START UP FRONT

- Precisely the point where the tool does its work.
- Precisely the point where profits are made and lost.
- Precisely the point where the accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

This is precisely the point, start up front with Jacobs.

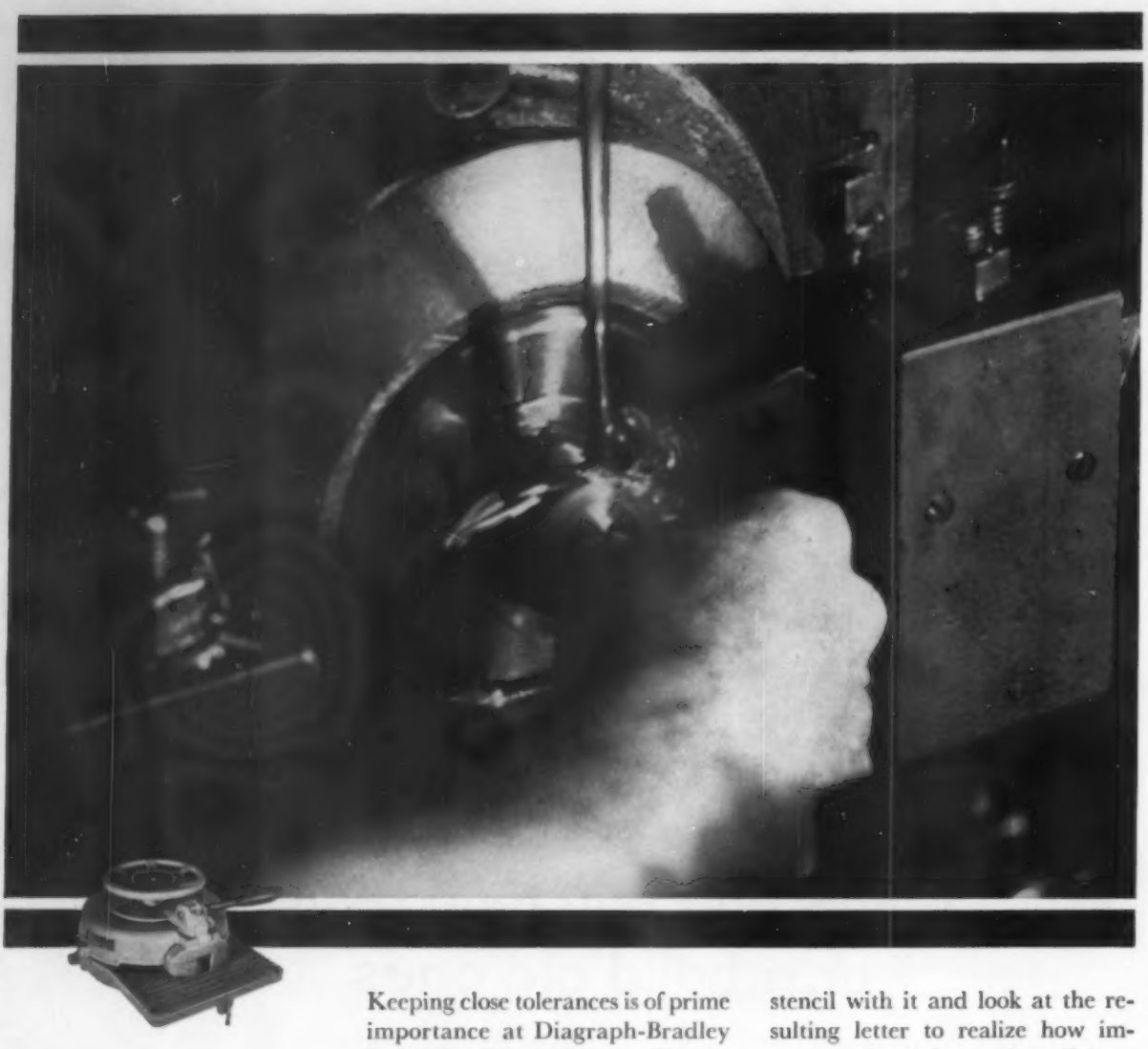
Finest machinists everywhere know the Jacobs Plain Bearing Chuck as standard equipment for portable power tools. They know it for *precision accuracy* and *powerful grip* . . . the most widely used chuck in the world.

INDUSTRIAL TEAMWORK

Your industrial supply distributor knows your business. He is always ready to fill your needs quickly and economically. When you need chucks you can depend on this industrial team—Jacobs and your Jacobs industrial supply distributor.

Jacobs
CHUCKS

THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT



COOL CUTS

Keeping close tolerances is of prime importance at Diagraph-Bradley Industries, Inc., of Herrin, Illinois, leading manufacturer of stencil machines and accessories. One of the ways this is accomplished is by keeping cutting edges cool.

At Diagraph-Bradley stencil punches must be cut and held within .0005 of an inch—a fine point of precision Diagraph-Bradley attributes to the cooling and lubricating effect of Cities Service Chillo 10 cutting oil.

"You have only to take a Diagraph-Bradley machine," says one of the company officials, "cut a stencil with it and look at the resulting letter to realize how important the right cutting oil is to our production."

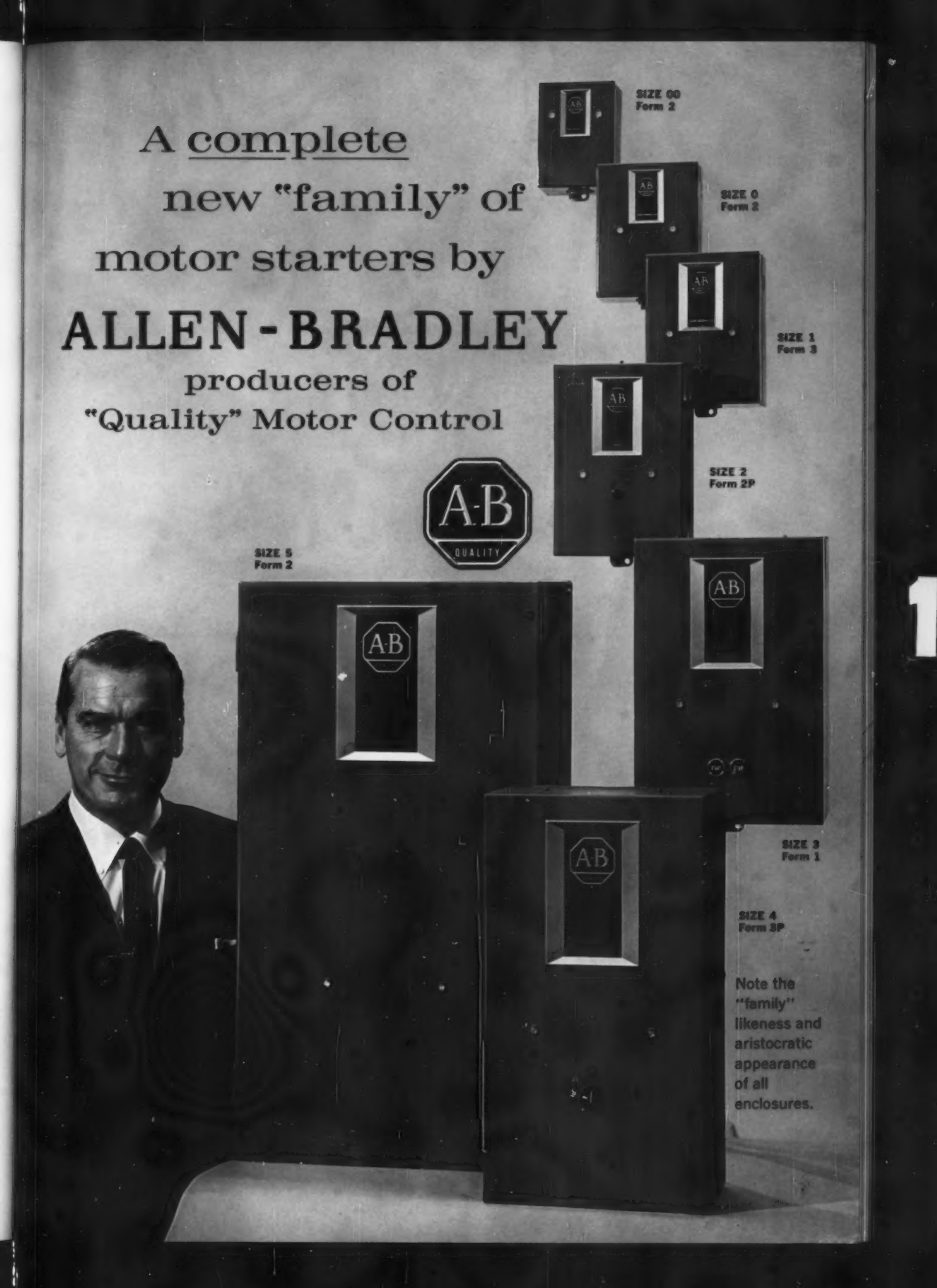
Cities Service Chillo 10 oil is a sulphochlorinated oil. The concentrations of sulphur and chlorine are stabilized by a special process, assuring uniformity of action through the entire cutting operation.

That's why, with Cities Service Chillo 10 cutting oil, work is always more accurate, clean and cool!

For full information call your nearest Cities Service office or write Cities Service Oil Company, Sixty Wall Tower, N.Y. 5, N.Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS


A complete
new "family" of
motor starters by
ALLEN-BRADLEY
producers of
"Quality" Motor Control
A-B
QUALITY
SIZE 00
Form 2
SIZE 0
Form 2
SIZE 1
Form 3
SIZE 2
Form 2P
SIZE 3
Form 1
SIZE 4
Form 3P
SIZE 5
Form 2
Note the "family" likeness and aristocratic appearance of all enclosures.

Greatest advance in motor

PLUS VALUES OF THESE NEW STARTERS

- smaller size
- greater interrupting capacity
- even more millions of trouble free operations
- more wiring room
- elegant styling
- A-B "quality" throughout

Thirty years of experience have gone into the design of this new Allen-Bradley line of motor starters. While retaining the principle of the simple solenoid design—with only ONE moving part—everything about these Bulletin 709 starters is **new**.

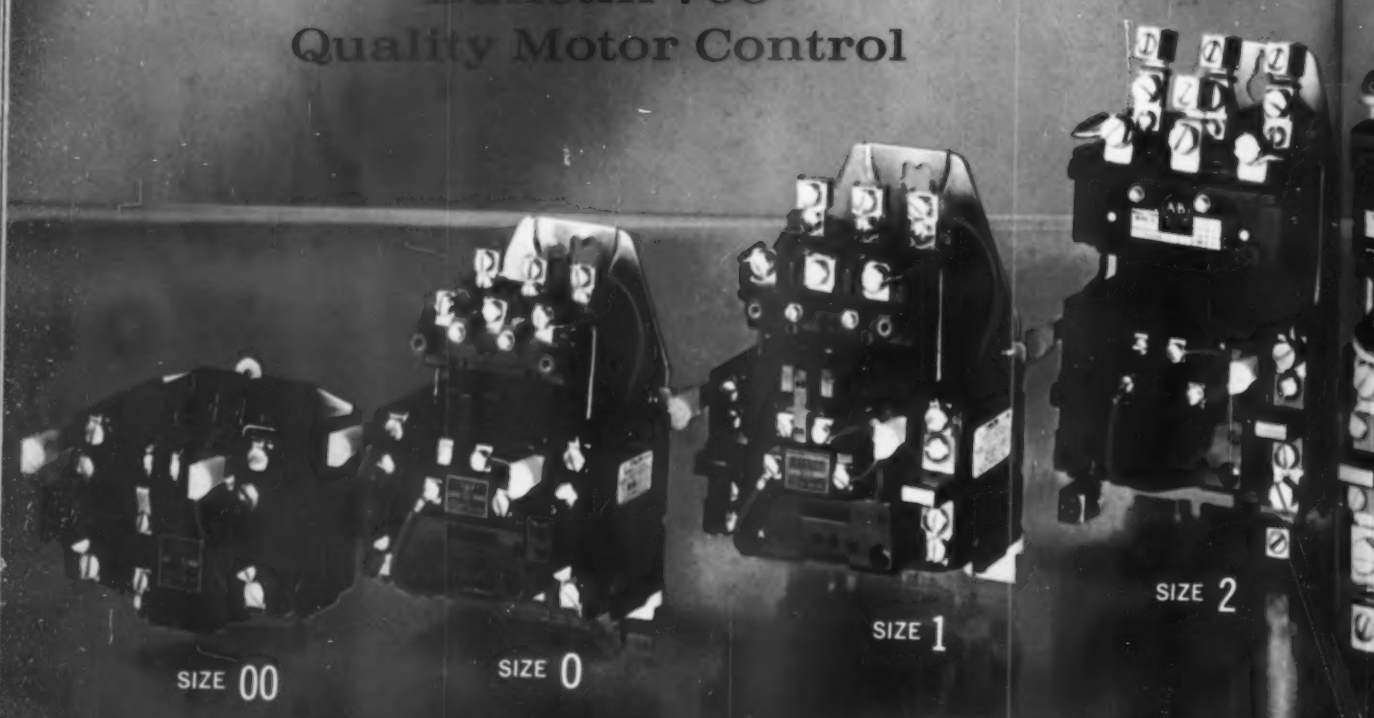
They're small—especially in the higher ratings. Yet, size for size, all tests have proved that they will outlast any starter now on the market—many times.

The **new**, patented, high-efficiency magnet—remarkably powerful for its weight and size—is cushioned to reduce shock and wear. The **new** coil is encapsulated for mechanical protection, and cannot be damaged by any corrosive atmosphere in which it may be used. The **new** precision hot molded arc hood confines the arc and increases the interrupting capacity.

ALLEN-BRADLEY

Bulletin 709

Quality Motor Control

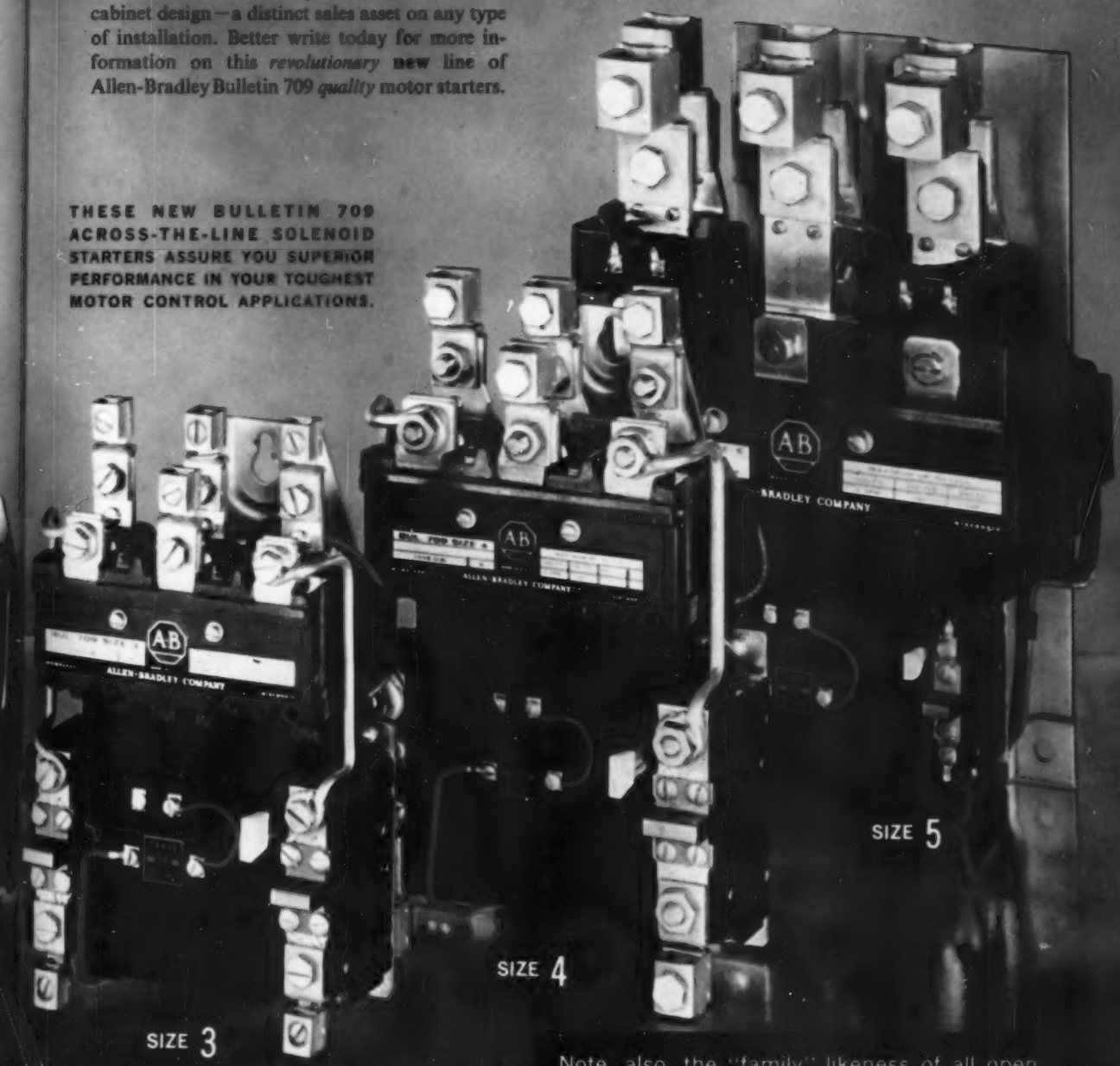


control...in 30 years!

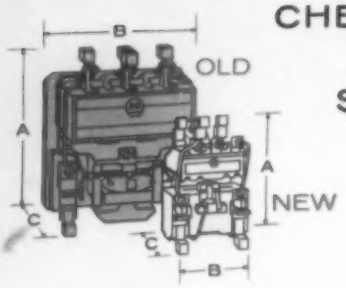
New weld-resistant, cadmium oxide silver contacts close and seat firmly, eliminating the sliding motion that causes wear. The overload relays are also **new** and are not only completely *trip-free* but also *tamperproof*. Of course, they were designed to use the **old** Bulletin 709 heating elements you have in stock.

Brooks Stevens is responsible for the **smart** cabinet design—a distinct sales asset on any type of installation. Better write today for more information on this *revolutionary* **new** line of Allen-Bradley Bulletin 709 *quality* motor starters.

THESE NEW BULLETIN 709 ACROSS-THE-LINE SOLENOID STARTERS ASSURE YOU SUPERIOR PERFORMANCE IN YOUR TOUGHEST MOTOR CONTROL APPLICATIONS.

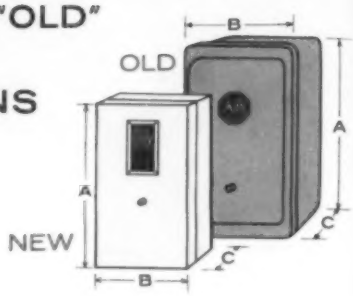


Note, also, the "family" likeness of all open type starters. Imagine the beautiful "special panel" engineering that can be done with this A-B family of starters, contactors, and relays.



CHECK THE "NEW" WITH THE "OLD" BULLETIN 709 SPACE-SAVING DIMENSIONS

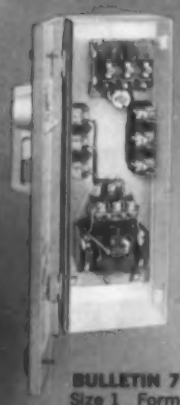
The wiring room in the new enclosure will delight the electrician.



TOTAL OVER-ALL DIMENSIONS

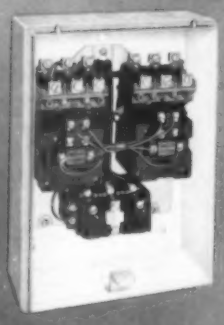
Starter Size	OPEN TYPE STARTERS						NEMA 1 ENCLOSURES					
	NEW			OLD			NEW			OLD		
	Height A	Width B	Depth C	Height A	Width B	Depth C	Height A	Width B	Depth C	Height A	Width B	Depth C
00	3 5/8	3 7/8	3 9/16	—	—	—	7 5/8	4 7/8	4 1/4	—	—	—
0	5 7/8	4 1/16	3 1/16	5 5/8	4 3/4	3 1/4	9 1/8	6 5/16	4 3/8	7 7/8	5 5/8	4 1/4
1	6 5/8	4 1/2	3 1/16	5 7/8	5	3 1/4	10	6 13/16	4 3/8	8 13/16	6 3/8	4 1/4
2	7 3/4	4 5/8	3 1/16	10 1/16	5 3/4	4 7/32	12	7 5/8	4 3/8	14 1/2	9	5 7/16
3	10 1/4	6 1/4	5 7/16	12 5/8	7 1/4	5 7/16	16 5/8	10 3/8	7	19 1/2	11 3/8	6 1/16
4	11 7/16	7 5/16	6 1/4	16 1/4	12 3/4	6 1/16	22	11 5/8	8	26 9/16	14 3/16	7 1/16
5	14 13/16	9	6 1/2	20	16 1/8	8 3/4	32 3/16	17 3/16	9 7/8	41 1/2	19 9/16	13 9/16

Also...other across-the-line starters in the NEW A-B design!



BULLETIN 712
Size 1 Form 2F
Fused Disconnect

BULLETIN 713
Size 2 Style RT
Circuit Breaker



BULLETIN 705
Size 1 Style RT
With Overload Relays

BULLETIN 715
Size 1 Two Speed
Consequent Pole

ALLEN-BRADLEY

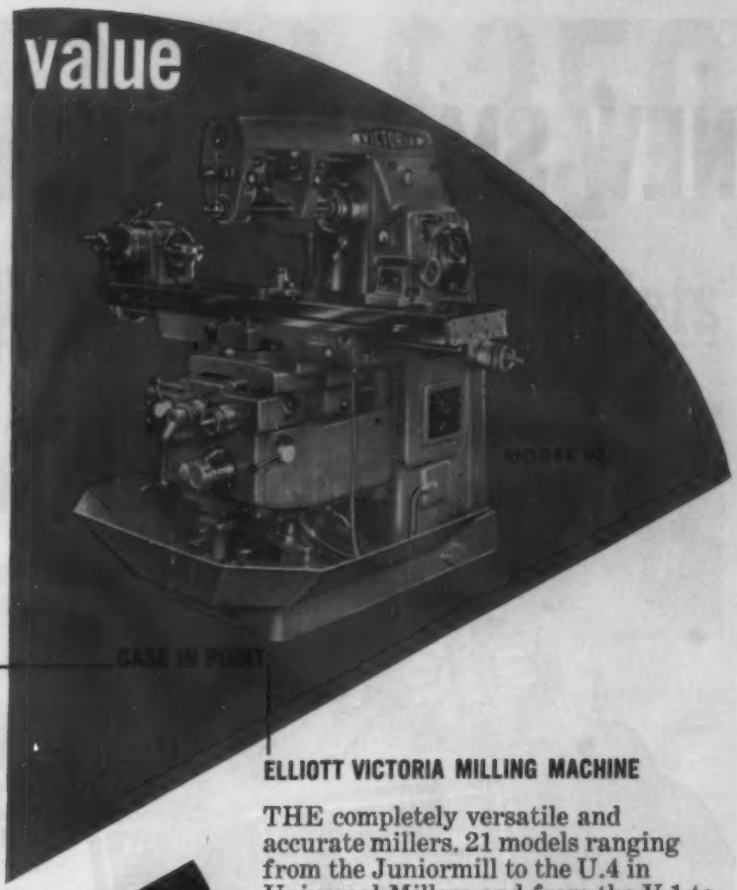
Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin

A-B QUALITY

you get more value with the ELLIOTT VICTORIA MILLING MACHINE

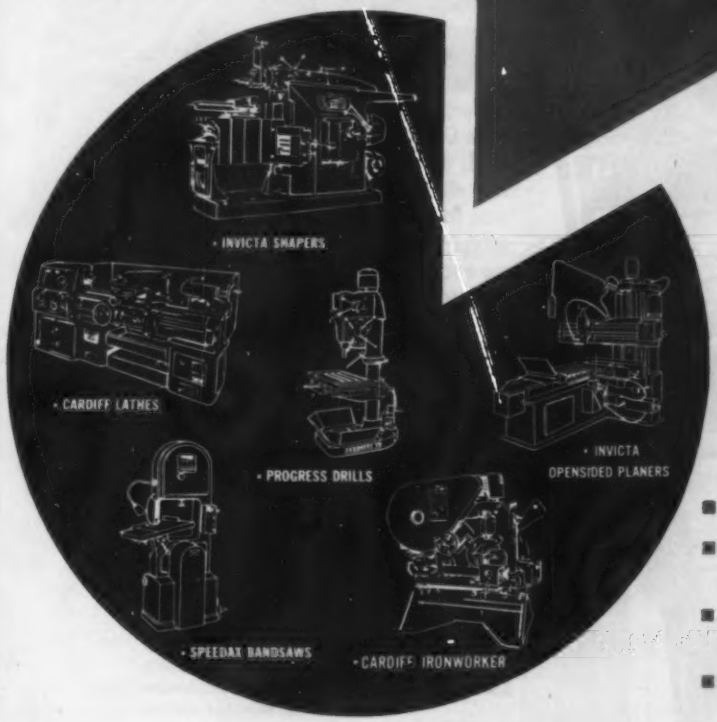


The diversification of precision machine tools manufactured by ELLIOTT are designed to fulfill your very specialized needs.

CASE IN POINT

ELLIOTT VICTORIA MILLING MACHINE

THE completely versatile and accurate millers. 21 models ranging from the Juniormill to the U.4 in Universal Millers and from the V.1 to the V.4 in Vertical Millers.



HEAVY DUTY YET COMPACT

Exclusive features designed to reduce production costs and to increase safety, speed and dependability:

- universal, plain and vertical models.
- automatic and rapid traverses all directions.
- total 54 feeds in 3 ranges .6" to 36" per minute.
- 12 speeds to spindle, inverted chain tooth drive from 8 h.p. motor.

ELLIOTT MACHINE TOOL Manufacturers (a division of the world's foremost machine tool manufacturers) fulfills the demand for quality MACHINE TOOLS and competitive pricing "backed" by all the advantages of domestic machine tools: ■ Factory Distribution and Service ■ Controlled Dealer Franchises ■ Frequent Personal Contact with our Executives ■ Full Inventory of Spare Parts ■ Factory Service Engineers ■ Factory Technical Service. HOME OFFICE AND PLANT: Port Hope, Ontario/LOS ANGELES, CAL.: 1128 Crenshaw Blvd./BOSTON, MASS.: 19 Brook Street, Needham Heights, 94/HACKENSACK, N. J.: 333 Main Street

ELLIOTT ELLIOTT OF LONDON **MACHINE TOOL MANUFACTURERS**

NEW SMALL MAGNETIC STARTER COSTS LESS, SAVES SPACE ON LOW-HORSEPOWER JOBS!

Square D NEMA Size 00 Starter Rated ¾ to 2 Hp for 3-Phase Service

• You no longer need to buy more starter capacity than you can use for low-horsepower jobs! This new Square D Size 00 starter is compact, easy to install, simple to use and maintain—and it costs 18% less than the Size 0 starter you formerly had to specify to get the advantages of magnetic control! With no sacrifice in quality, this new starter provides: straight-through wiring—pressure-type terminals—1-piece overload relays for complete motor protection—pushbutton or selector switch optional in the cover. Also available without overload relays.

GET THE COMPLETE STORY! Write for Bulletin 9M-297. Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin.

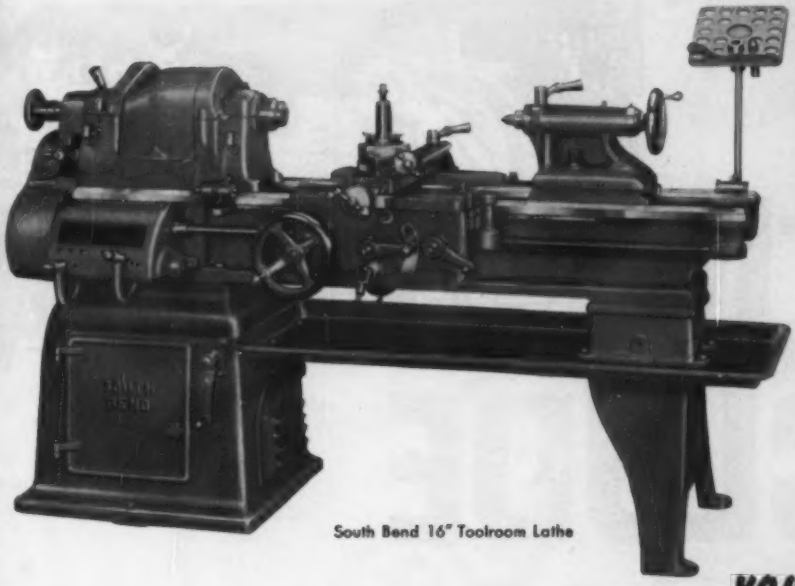
New starter is available either open or in NEMA Type 1 enclosure. Enclosure shown with selector switch in cover.

SQUARE D COMPANY

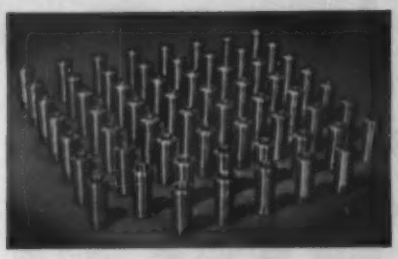
wherever electricity is distributed and controlled

SAVE UP TO $350

on South Bend toolroom lathes with collets



South Bend 16" Toolroom Lathe



Take advantage of this unmatched offer . . . purchase any South Bend Precision Toolroom Lathe before May 1st and you will receive a set of South Bend Collets without extra charge. These are precision, milled thread, heat treated collets for round work.

Don't wait . . . mail the coupon now!

YOU SAVE

LATHE	PRICES START AT	COLLET CAPACITY, MAX.	COLLETS IN SET	SIZE RANGE by 64ths	VALUE of COLLETS
16" Toolroom	$3230	1 1/16"	61	1/16" to 1"	$350.75
14 1/2" Toolroom	2760	1 1/16"	61	1/16" to 1"	350.75
13" Toolroom	2358	1 1/16"	61	1/16" to 1"	350.75
10" Toolroom	1783	1 1/16"	61	1/16" to 1"	350.75
10" Toolroom	1590	1 1/16"	41	1/16" to 1 1/16"	196.80
10K Toolroom	815	5/8"	37	1/16" to 5/8"	173.90
9" Toolroom	726	1/2"	29	1/16" to 1/2"	130.50

prices f.o.b. South Bend, Ind., less electricals

Special Offer Expires April 30, 1961

SOUTH BEND LATHE

A Subsidiary of American Steel Foundries

BUILDERS OF LATHES • MILLING MACHINES • SHAPERS
DRILL PRESSES • PEDESTAL GRINDERS

SOUTH BEND LATHE, INC., South Bend 22, Indiana

Send us complete information on special Toolroom Lathe offer and Time Payment Plan.

Name_____ Title_____

Company_____

Street_____

City & Zone_____ State_____

COMPARE EDIT
AUTHORITY
AND
YOU'LL
CONCLUDE
THIS IS
METALWORKIN
MOST POWERF
SELLING TOOL

ORIAL

G'S UL

In metalworking—men who matter read...

American Machinist / Metalworking Manufacturing

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N.Y.

AM/MM is edited exclusively for men who make things of metal—whether it's a Diesel locomotive or the delicate balance wheel of a watch—men who have a community of interest in the methods, techniques, tools, machines and materials of metalworking.

It's a technical publication for technical men—a work book that shows its readers how to manage metalworking operations and manufacture things from metal more efficiently, more profitably.

When a man reads American Machinist/ Metalworking Manufacturing, we guarantee he will not be left uninformed about any phase of metalworking—a policy that has earned us an all-paid circulation (ABC-audited) of top manufacturing managers, engineers and plant managers in the eight basic SIC classifications that make up metalworking.

Analyze the how-to articles on technology and management techniques, the case histories and working information in any issue, and you, too, will conclude that AM/MM is metalworking's most powerful selling tool.

For up-to-date facts and figures on metalworking, ask your AM/MM district manager for a copy of the 1960 Market Guide for Sales Executives.

New ARMSTRONG Swivel Pad can't come off

Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 45°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

See Us At Booth 3906
ASTME Show, New York Coliseum

ARMSTRONG BROS. TOOL CO.,

5215 W. ARMSTRONG AVE.
CHICAGO 46, ILLINOIS

NUMERICAL CONTROL FOR PRODUCTIVE PRECISION BORING

Fosmatic numerical control is also available on Moore-Fosdick jig grinders.

FOSMATIC N/C PRECISION BORING MACHINES

Four models from the compact "32" with 18″ x 30″ table travel, to the big "54" with 28″ x 48″ travel. All available with Fosmatic electro-mechanical tape control for table position, spindle depth, head height, speeds, feeds, and tool changing. Fosmatic control positions workpieces accurately to ± .0001″. Fosmatic jig borers make provision for numerical control in the basic design and can be furnished in any degree of automation.

Get a proposal from

The Fosdick Machine Tool Co., Cincinnati 23, Ohio

FOSDICK

INTERNATIONAL
GRAPHITE
CUTS MATERIALS
HANDLING COSTS
$16,398
WITH MOBIL!

● In addition to direct savings through use of premium oils and greases, there have been immediate and long-term cost reductions through greater engine efficiency and driver training. Gasoline savings have been particularly impressive. Despite increased plant activity, International Graphite has achieved a 30 month total savings in lower gasoline costs of over $5,692.

● For vehicular materials handling units, Mobil made these recommendations: installation of hour meters; proper use of premium lubricants; servicing on a 50-operating-hour basis (about 2 weeks) rather than on a rigid once-a-week schedule. Air cleaners better suited to the conditions of operation were installed. As a result, scheduled servicings have been reduced by an average of 633 annually. In the past 30 months cost of oil, grease and labor have been reduced $8,206.

● International Graphite's Maintenance Superintendent, Mr. Mel Price, center, reports that there have been substantial savings, too, in the area of motor overhaul. Prior to changes recommended by Mobil in 1958, complete motor overhauls averaged 9 a year on 25 vehicles. During the last 30 months, this has been reduced to an average of 7 a year. Resultant savings in reduced labor and parts costs have amounted to $2,500.

● For over 20 years, Mobil has helped reduce costs for the International Graphite and Electrode Division of Speer Carbon Company, Niagara Falls, New York, a major producer of such finished graphite products as anodes, electrodes, and molds, as well as specialties for the railroad, chemical and munitions industries.

International Graphite faces exceptionally severe maintenance problems because of highly unusual conditions at the plant. Abrasive particles of carbon, sharp sand and silicon-carbide find their way into all types of materials handling equipment, necessitating a heavy schedule of preventive maintenance. By recommending superior lubricants and improved PM techniques, Mobil Engineers have helped International Graphite effect an additional $16,398 reduction in costs of maintaining and operating this equipment during the past 30 months.

Consistently over the years, Mobil has *proved* its value to industry. To learn how Mobil may help you, call your nearest Mobil Representative. Or write, Mobil Oil Company, 150 East 42nd St., New York 17, N. Y.

Mobil

CIRCLE 204 READER SERVICE CARD

NEW BROKEN TOOL DETECTOR

"Detect-A-Tool" is the new space saving solution to the problem of detecting tool breakage on automatic machine tools and transfer lines.

Expensive probe stations are eliminated as well as their attendant maintenance cost and floor space requirements, as the "Detect-A-Tool" is mounted on the work station itself.

Since the tools are checked each time they are used, tool failure is detected immediately and scrap losses from tool failures are eliminated.

"Detect-A-Tool" equipment can be easily installed on both old and new equipment. There are no complex moving parts to wear or get out of order, and little or no maintenance is required. Coolants, oils, or chips will not affect operation in any way.

"Detect-A-Tool" units are presently available for tools having effective diameters from 3/32" to 3/4".

This equipment features the same rugged construction and conservative electrical design that typifies all "MEK" products.

Complete "Detect-A-Tool" descriptive literature will be sent on request.

Manufacturers of
- *Electronic and Magnetic Controls*
- *Motor Control Centers*
- *Fabricated Electrical Enclosures*

MEK
Machinery
Electrification, Inc.
62 Hudson St., Northboro, Mass.

LETTER from the PUBLISHER

You Have a Right To Insist

You have a right to insist, as a reader of business papers, that the editors give you nothing but the best. But what is the best? Well, naturally that depends on what you think is the best for you. Here are some guideposts you may want to use in judging whether your business paper is doing the kind of editorial job for you that it should:

It must be timely . . .

Is it timely? It should cover all the important new developments in your field first . . . before you read about them anywhere else.

Is it accurate? It should present all the essential facts. You should be able to rely on what it says. The editors should make it easy for you to distinguish between opinion and fact.

Is it complete? A good business paper should give you the whole story . . . complete information so you will have all the facts with which to make a decision. If some of the facts are left out, you may be badly misled.

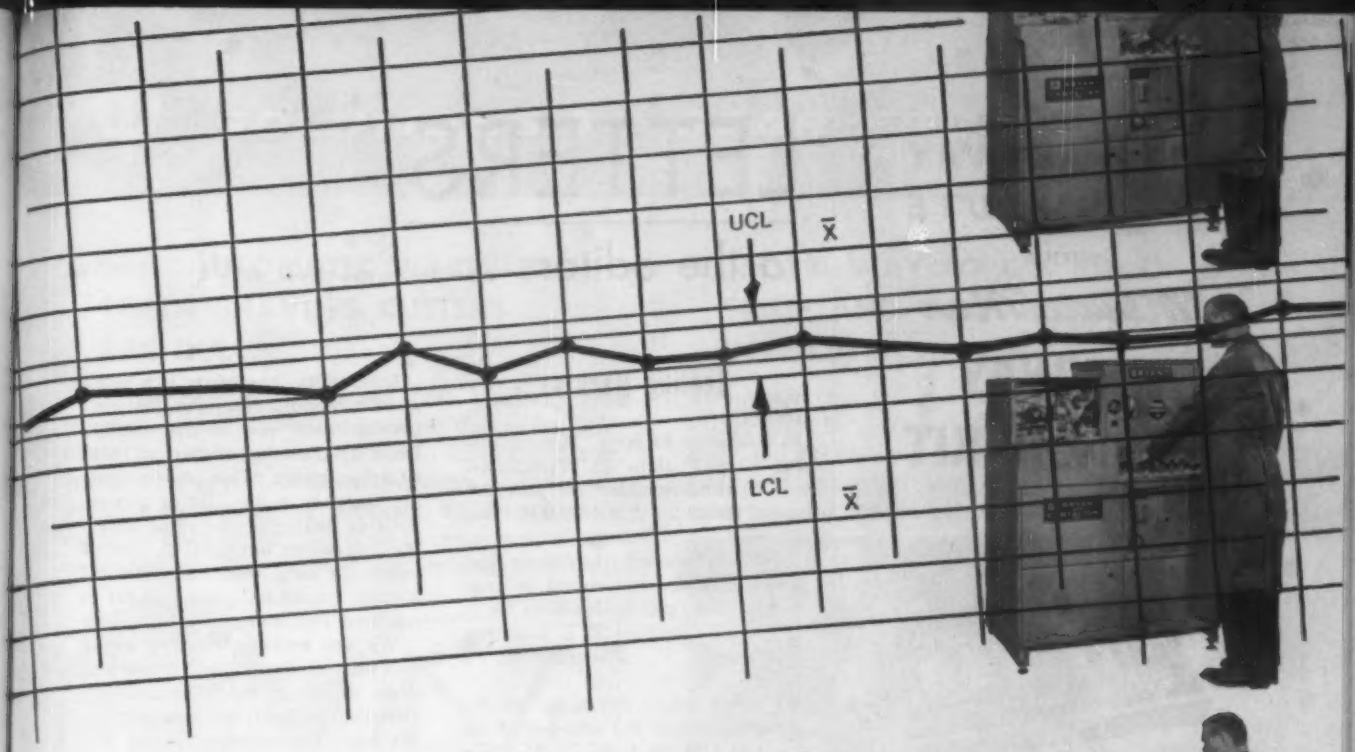
The editors take responsibility . . .

Is it responsible? If you intend to make decisions based on information you get from your business paper, you need assurance that the editors take full responsibility for what they print.

Is it courageous? You want your business paper to print the unbiased facts . . . the truth . . . even if it hurts. A diet of "pap" may make for more pleasant reading, but it is bound to be a distortion of the truth.

We on AM/MM have been doing our best for many years to live up to these standards. We propose to continue to do so.

George Reppert



TEST CURVES LIKE THIS

PROVE OUT

BRYANT GRINDERS

The test curve above is typical. It shows the average size variation of the I.D. in a run of sample parts ground to customer specifications on a Bryant Internal Grinder. From this curve and other data, Bryant engineers evaluate the machine's *long term* precision capabilities, using mathematical laws of probability. Result: a job-engineered machine, tested under actual production conditions — *proved out* by statistical quality control methods. Logical reasons why a Bryant Production Internal Grinder is best suited to maintain the required quality standards in *your* plant. Contact your nearest Bryant or Ex-Cell-O sales representative for full details.

BRYANT

Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT, U.S.A.

Internal Grinders • Special Machinery

This Model "B" Centalign® provides quick changeover and high precision on short or long production runs of small workparts.

CIRCLE 206 READER SERVICE CARD

CUT A KEYWAY IN 1 MINUTE
WITH A
Minute Man®
KEYWAY
BROACH KIT

With one, you can cut a keyway in one minute for **as little as one cent** by hand with an arbor press. Twenty different kits available from stock for keyways from 1/16" to 1" in any bore from ⅛" to 3".

Save Time With
STANDARD STOCK SQUARE BROACHES

Starting with a round pilot you can finish an accurate square hole in one pass in less than one minute. Hexagon and round broaches also available.

The duMont Corp., Greenfield, Mass.
MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Hexagon Broaches, Production Type Keway Broaches and Keyway Broach Kits to

Name.....
Company.....
Address.....

duMont

Booth No. 3215, ASTME Show, N.Y. Coliseum, May 22-26

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Sealing Machine

Dear Sirs:
In reference to your "Metalworking Report" item on "FORMING . . . Sealing machine for powdermetal parts . . ." (*AM/MM*—Dec 12 '60, p4):

Please forward the name and address of the individual to contact at National Sinter-Seal Co.

D S Tillotson
Philadelphia, Pa

We don't know the name of the individual, but the address of the company is as follows: National Sinter-Seal Co, 689 Seneca Industrial Center, Buffalo 10, N Y—Ed.

Wrong Number

It has come to our attention that a regrettable mistake was made in the *Buyers' Guide Issue* (*AM/MM*—Jan 23 '61) in the listings for Mid Atlantic Machinery Co of Ardmore, Pa. This was brought about by a change in distributorships that was not correctly reported to us by our usually reliable sources—the machine tool companies that appoint the distributors.

Essentially, the error is a mix-up of telephone numbers. In connection with one of the entries, Leon L Clore, president of Mid Atlantic, states, "This phone number happens to be that of a competitive dealer in the same area." He also points out that ". . . naturally, our own phone number, MI 9-4545, would be more helpful to us than our competitor's."

We are extremely sorry about this mix-up that caused three separate errors in the Machine Tool Distributors section (blue paper). We hope the revisions below will make amends, at least in part. These are the correct entries for your *Buyer's Guide Issue*.

On p667, under Cleveland Crane & Engineering Co, the Philadelphia entry should be as follows: Mid Atlantic Machinery Co (Ardmore), MI 9-4545.

On p697, under Pines Engineering Co, Inc, the Philadelphia entry should be: Mid Atlantic Machinery Co (Ardmore), MI 9-4545.

On p727, substitute this entry: Mid Atlantic Machinery Co . . . Pa, Suburban Square Bldg, Ardmore, MI 9-4545.

Unfortunately, this correction

SHOPMATES

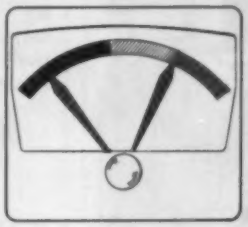
N. Jarvis

WHEN I WANT A JOB DONE, I WANT IT DONE! NO EXCUSES---- NO BUCK PASSING---- NOW!! WHY HAVN'T YOU FINISHED THOSE GEARS???
B-B-BECAUSE---- Y-YOU G-GAVE 'EM TO BERT!!
WELL BERT?
THEY BEEN ON HIS DESK FOR A WEEK!
N. JARVIS

SOLUTIONS TO GEAR PROBLEMS

WANTED: AUTOMATIC WARNING WHEN SHAVING CUTTERS ARE DULL

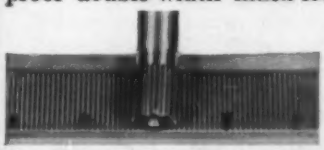
This has been solved in the new Mark II gear finisher. An indicator connected to the cutter drive circuit registers power required to drive the cutter, warns when preset 'dullness' is reached. Device also protects against cutter breakage by dropping the machine knee or warning if an oversize gear should be loaded into the machine. Ask for Bulletin 870-60.



The Mark II gear finisher is full of new features

WANTED: A SIMPLER WAY TO PRODUCE SPLINES 'FOOLPROOF' IN ASSEMBLY

Such splines can be produced without additional operations or time on Roto-Flo machines. A foolproof double-width index-locating spline tooth is created simply by grinding off one end of the forming rack teeth at the locating point. Incidentally, the Roto-Flo produces such a spline in just a few seconds. Ask for Bulletin RF-60.



A Roto-Flo produces splines, threads, grooves, in one pass

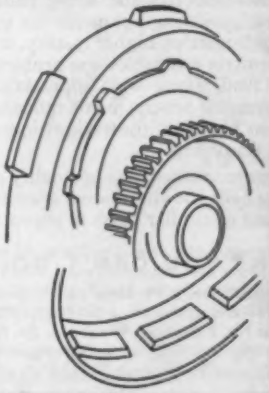
WANTED: A WAY TO GET RID OF SETUP AND 'FEEL' ERRORS IN INVOLUTE CHECKING

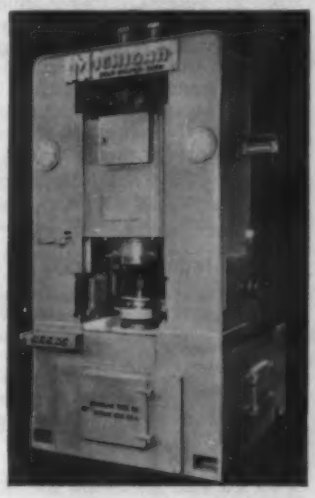
To answer this, we now have available an optical attachment for setting the sine-bar on ANY Michigan Tool #1124 involute checker. Remarkably fast and provides greater setup consistency for increased accuracy. Ask for Bulletin 1124-60.

Fast optical sine-bar setting on an 1124 involute checker

WANTED: A SINGLE PROCESS FOR CUTTING ALL KINDS OF INTERRUPTED TOOTH FORMS IN DIFFERENT MATERIALS

We already had the answer to that: the Shear-Speed gear shaper. This machine will cut practically any peripheral shape—spur involute and straight teeth, interrupted or not, cam forms, ratchets, etc., in steel, cast iron, aluminum, and even plastics—in a small fraction of the time required by other processes. Ask for Bulletin 3000-60.





(above) A few of the many shapes produced in one plant by the Shear-Speed

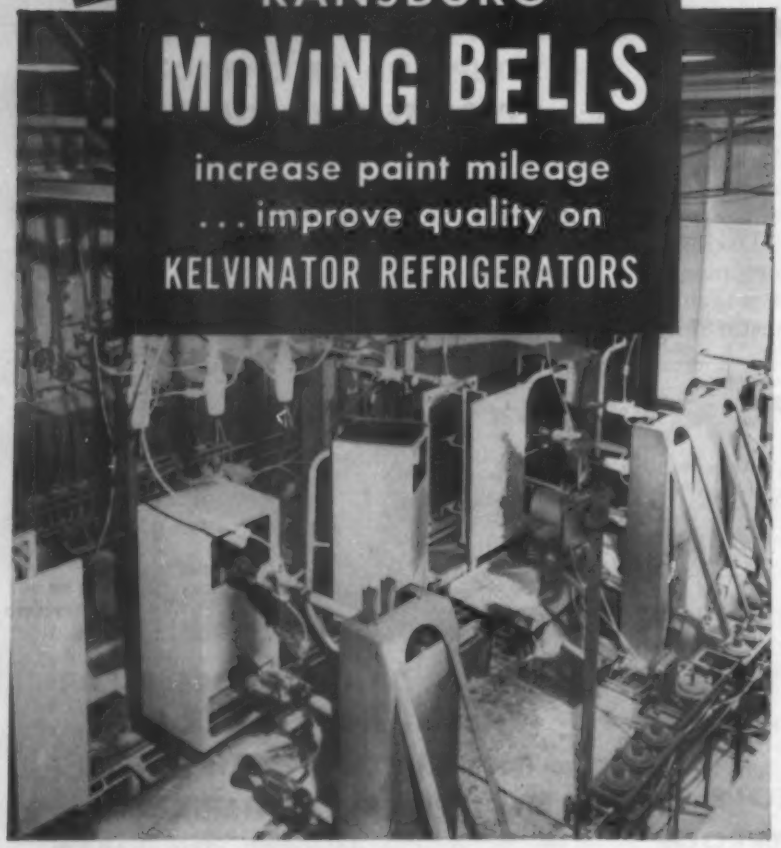
MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN

NEW

RANSBURG

MOVING BELLS

increase paint mileage
... improve quality on
KELVINATOR REFRIGERATORS



Ransburg's No. 2 Process moving bells—latest innovation in electrostatic painting—automatically paint mixed sizes of refrigerator cabinets and doors on Kelvinator's new finishing line.

On this job—first of its kind—limit switches re-position the reciprocating bells to accommodate various model sizes mixed on the same line. And, electric eyes selectively trigger the paint on and off between parts.

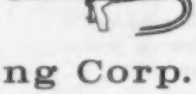
RESULTS? Automatic electrostatic spray painting—which replaced a battery of reciprocating automatic air guns—is providing Kelvinator with a beautiful, higher quality, and more uniform finish. Rejects, formerly a troublesome problem, have been practically eliminated. And, along with appreciable labor savings in this highly automated set-up, paint mileage is substantially improved . . . even bettering the savings indicated in pre-installation lab tests at Ransburg.

Like Kelvinator, other manufacturers of quality products will find Ransburg's moving bells the automation answer for production lines where batching of similar parts is impractical.

NO REASON WHY YOU CAN'T DO IT, TOO!

Want to know how Ransburg No. 2 Process can improve the quality of YOUR painted products—and at the same time—cut YOUR paint and labor costs? Write for our No. 2 Process brochure. Or, if your production doesn't justify automatic painting, let us tell you about the No. 2 Process Electrostatic Hand Gun which can be used in either conveyorized, or non-conveyorized painting.

RANSBURG



RANSBURG Electro-Coating Corp.

Box 23122, Indianapolis 23, Indiana

does not undo the errors that were made, and we have to agree with another of Mr Clore's comments: "This listing could have been completely omitted and been more helpful to us."

However, this is the best we can do until the next *Buyers' Guide Issue*, which we hope will be of more value to Mid Atlantic—Ed.

An Honest Judge

Dear Sirs:

Re: Your letter asking me to judge the Practical Ideas in the February 20 issue.

Naturally, I would not vote for my own Practical Idea when called on to serve as a judge in the contest. I trust you will discount any and all such votes, if they ever appear, for the sake of fairness and good taste.

H Landauer
Tampa, Fla

It was purely coincidental that Reader Landauer was asked to judge a group of Practical Ideas that included one of his own—and an amazing coincidence at that.

The judges for each group are selected at random from the entire list of our 45,000 subscribers, so it's only a small percentage of readers who are asked to serve in that capacity. Then, when you consider that not all our readers submit Practical Ideas and that only the best of those are published, it becomes obvious that a coincidence such as this one would be extremely rare—Ed.

AM/MM

"That reminds me of what the boss said this morning when I came in late."

CALENDAR

American Welding Society — Annual Meeting and Welding Show, Apr 17-21, Commodore Hotel and Coliseum, New York.

National Institute for Disaster Mobilization — Mutual Aid and Disaster Control Seminar, Apr 18-20, Shamrock Hilton Hotel, Houston, Texas.

American Society of Mechanical Engineers—Metals Engineering Conference, Apr 23-26, Penn-Sheraton Hotel, Pittsburgh, Pa.

Metal Powder Industries Federation — Annual Meeting and Powder Metallurgy Show, Apr 24-26, Hotel Sheraton-Cleveland, Cleveland, Ohio.

American Institute of Mining, Metallurgical, & Petroleum Engineers—High-Temperature Materials Conference, Apr 26-27, Carter Hotel, Cleveland, Ohio.

National Screw Machine Products Association—Annual Meeting, Apr 29-May 3, Summerset Hotel, Boston, Mass.

American Foundrymen's Society —Castings Congress and Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

National Industrial Production Show of Canada — May 8-12 Canadian National Exhibition Park, Toronto, Ont.

Material Handling Institute — Eastern States Show, May 9-11, Convention Hall, Philadelphia, Pa.

American Society of Mechanical Engineers — Production Engineering Conference, May 10-12, Royal York Hotel, Toronto, Ont.

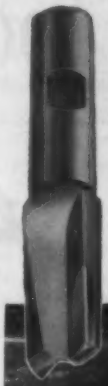
American Institute of Industrial Engineers — National Conference and Convention, May 11-13, The Sheraton Cadillac, Detroit, Mich.

Machinery Dealers National Association — Annual Convention, May 15-18, Shoreham Hotel, Washington, DC.

American Society for Quality Control — Annual Convention, May 22-24, Sheraton Hotel, Philadelphia, Pa.

MAJOR AIRCRAFT MANUFACTURER MAKES...

Fully Automatic Savings with NELCO TOOLS on Tape Controlled Miller!



PROFILE MILLING AROUND WING SECTION

OPERATION #1

MATERIAL	Aluminum Alloy, Tough & Abrasive.
CUTTER USED	2" diameter, 2 flute NELCO Carbide Tipped End Mill. Negative Helix.
SPEED	3600 R.P.M., 1900 S.F.M.
FEED	20" per minute.
WIDTH OF CUT	1½".
DEPTH OF CUT	3/16 to 3/8 inch.
PRODUCTION	Nelco End Mill conformed to aircraft tolerances and to rugged automated production schedule.

There are 121 Nelco End Mills specially engineered to mill Aluminum.

Machine: Giddings & Lewis, 2 spindle vertical, 100 H.P. each spindle, tape controlled

FACE MILLING WING SECTION

OPERATION #2

MATERIAL	Aluminum Alloy, Tough and Abrasive.
CUTTER USED	Standard 6" diameter Nelco Face Mill modified with 30° chamfer.
SPEED	3600 R.P.M., 5400 S.F.M.
FEED	80" per minute
WIDTH OF CUT	6"
DEPTH OF CUT	¼ to 3/8 inch.
PRODUCTION	2 cubic feet of metal removed in 20 minutes. 6 pieces per grind—12 cubic feet of metal removed per grind.

Again, NELCO Carbide Tipped Tools prove their economy and dependability. NELCO manufactures the most complete line of Carbide Cutting Tools engineered to mill ALUMINUM. They are available through your Local Distributor.

Send for the NELCO Catalog today!

For that EXTRA Edge in Production!

NELCO

NELCO Tool Co., Inc.
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

9 questions you should ask about numerical machine tool controls

1

Has the system, through actual use, proven to be a money saver?

Many new controls on the market today have yet to be installed on their first customer application. However, Hughes numerical positioning controls have been successfully operating in customer plants for over a year and a half! One typical Hughes customer was able to cut tool costs by $3000 and reduce lead time by 50% on a run of 50 missile parts.

2

Is it competitively priced?

Many people are surprised that Hughes systems, with all their advantages, are often priced lower than competitive units.

3

How many machine axes can I control?

Hughes provides either two or three axis controls – in the same cabinet. And, with the Hughes system, you can purchase a two axis control now, and add the third later.

4

Are special skills required to prepare the tapes and operate the machine?

Not with the Hughes system. Anyone familiar with general machine shop practices can prepare the tapes and operate the machine after only two days training!

5

Can I get high accuracy – and, is that accuracy repeatable?

Hughes two-axis controls offer you repeatable accuracies of ±0.0002 inch with a resolution of ±0.001 inch. Adding the third axis, repeatable depth accuracies of ±.0005 with a resolution of ±0.001 inch can be obtained.

6

Will I need a great deal of service after sale?

Maybe you've heard about numerical control systems that require a lot of service. Not so when you specify a Hughes Numerical Machine Tool Control. Customers report that "up time" is over 95% – after a full year of operation!

7

Is the system transistorized for maximum reliability?

The Hughes Transistorized System is much less sensitive to vibration, shock and temperature fluctuation. Result: with Hughes transistorized circuitry you get higher reliability and minimum maintenance.

8

Is the tape reader fast and reliable?

Mechanical tape readers have two inherent disadvantages: they are relatively slow and they tend to deform the tape holes. Not so with photo electric tape readers – the type used on Hughes controls. They're extremely fast (eliminating need for costly electronic storage) and they do not injure the program tape.

9

Does the manufacturer have a reputation for standing behind everything sold?

Hughes gets an emphatic "yes" to this question. Hughes has built a reputation as a *world leader* in advanced electronics and has a world wide service organization.

Find out more about how Hughes Numerical Controls

can increase your profits. Write, wire, teletype (TWX INGL 4117) or call direct: Hughes Industrial Control Systems, Dept. No. 92-21, P. O. Box 90904, Los Angeles 45, California. For export information please write: Hughes International, Culver City, California.

CREATING A NEW WORLD WITH ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
INDUSTRIAL SYSTEMS DIVISION

SPOT NEWS...

- **Inert tungsten arc heating** has proved satisfactory for experimental hot machining of non-magnetic materials, according to a report by Cincinnati Milling Machine Co on Phase II of its research into high-temperature machining methods for Air Materiel Command.
- **A tax credit or investment allowance of anywhere from 5 to 20%,** which President Kennedy is expected to propose to Congress is "an aspirin where a wonder drug is called for," according to the Machinery & Allied Products Institute and the Council for Technological Advancement, which are pushing for 20 to 30%.
- **"Fluid sizing," a coolant metering method** which reflects hydraulic back pressure to an electrical control to stop honing of cylinder bores when a required dimension is reached, will be used on microhoning equipment now being readied by Micromatic Hone Corp, Detroit, for a major automaker. Coolant flows directly to the work surface through precision orifices, escapes along the cylinder walls, acting as a cutting fluid and as a gaging medium.
- **Value analysis is being tailored to production of missiles** at Redstone Arsenal as a joint effort of the Army and its contractors. In essence, the Army is using it as a continuing scrutiny of weapons system parts to eliminate frills, expects it to cut missile production costs drastically.
- **Standardized lengths of coated abrasive belts** (there are currently 104 different belt lengths from 12 through 168 inches being manufactured) are the goal of the Coated Abrasive Manufacturers Institute, which claims lack of standardization makes for unwieldy inventories, purchasing difficulties, and manufacturing expense. CAMI proposes instead 31 lengths—in increments from 12 through 36 in., and 6-in. increments from 42 through 168 in.
- **East Germany is collaborating with India in setting up a machine tool plant,** a subsidiary of India's state-owned Hindustan Machine Tools Ltd somewhere in the Punjab (northern India). East Germany will supply technical know-how, India the $10.5-million initial investment. Also in the works for India: production of toolbits with the aid of Austria's Bohler Bros Ltd.
- **Heat-resistant sintered copper alloys** (copper alloyed with aluminum oxide and magnesium oxide), developed in Russia, have exceptionally high electric conductivity. Alloys are expected to replace more-expensive copper.
- **Advanced electronic tools may now be leased** from a new San Diego, Calif, firm, Technical Leasing Co, which will lease anything from inexpensive oscilloscopes to complex computers to such clients as missile and aircraft manufacturers, electronics companies and instrument makers.
- **East Germany will supply $5.6 million worth of machine tools** to the United Arab Republic, to be used in Egypt and repaid over five years at 2.5% interest.
- **A firm which refuses to bargain over the "agency shop"** (substitute for a closed union shop in states which have Right to Work Laws) is not violating Taft-Hartley, the National Labor Relations Board has ruled. In essence, agency shop requires agreement from a company to collect a fee equivalent to union initiation and dues from employees, even though those employees do not belong to the union which represents them. Test case involved UAW vs GM in Indiana.
- **Cuba has** just purchased, and received, a complete barbed wire mill, including galvanizing facilities, from Japan.
- **Several new processes have a high potential for joining of space age metals,** but they still have bugs to be worked out. Among them: Plasma-arc welding (too much jet force), explosive welding (still hard to control), and auxiliary vibration during arc welding (suitable method needed for coupling vibrations to the weld pool), according to R E Monroe, ASME Aviation Conference.

with men who know cutting tools... it's MORSE everytime

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SEE YOUR NEARBY MORSE DISTRIBUTOR

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WASHINGTON... TRENDS

Export credits ease . . .

The Kennedy administration hopes to stimulate exports of hard goods, including machine tools, with new export credit policies being developed by Export-Import Bank and Treasury Dept.

Kennedy told Congress, in a message on the balance-of-payments situation, that he has ordered the two agencies to recommend policies for easing export credit facilities and to offer US exporters credit opportunities equal to or better than those available to foreign firms.

Ex-Im bank wants to expand its activity, particularly in the area of medium-term loans, covering transactions from six months to five years. Exporters have cited the need for this type of loan as most acute.

Plan is for the Government bank to cooperate with private groups of banks and insurance companies. Details are still being worked out, but the thinking is that if insurance companies cover normal commercial risks (with government guarantees covering political risks) private banks will be more willing to extend credit. Government economists expect eased credit to reflect itself especially in increased exports of durable goods.

Rosier look at the economy . . .

The gloomy view of the nation's economy pronounced by President Kennedy when he took office two months ago is being replaced by cautious optimism by officials here. Evidence that the recession is "bottoming out" and that an upturn can be expected by mid-year is changing the flavor of statements of the President and his advisers.

The official view is this: While an upturn is coming, there's no evidence that it will take on boom proportions. The national economy never completely pulled out of the 1957-58 recession. Therefore the current one started from a lower base. Unless the Kennedy program of economic stimulants is enacted, the White House argument goes, the recovery is likely to be sluggish. The view is that hard-core "structural" unemployment resulting from automation and foreign competition for instance, is a problem that must be dealt with on its own.

Administration tax policy . . .

Tax incentives for business to stimulate modernization of plant and equipment were plaguing the administration right up to the last minute. The reason is that not much that's new can be offered. The message sent to Congress can include only ideas or a combination of ideas about which nearly every interested party has some relatively firm opinions.

Take, for instance, the investment credit idea recommended by Stanley S. Surrey, Assistant Treasury Secretary for Tax Matters, in his task force report to the President. This is called a "bonanza" in Congressional circles—and is not favored by businessmen.

Surrey, because of his many printed views on a wide range of tax matters, got rough treatment from Senator Byrd's Finance Committee when it was considering his nomination. One objective: to let the administration and others know that the Committee thinks Surrey is already committed on many tax matters to views which they do not favor.

Certainly a consensus around Washington is that a liberalization of depreciation allowances is the kind of incentive most likely to meet with approval. But right up to the last minute, Treasury officials were saying that even they had not yet made up their minds.

One thing you can count on: The final recommendation in this matter, as in many others, will be made by Kennedy. The White House has been kept informed of the Treasury's preparatory work.

Labor-management parleys . . .

Automation and the threat of foreign competitive products head the agenda for the first working session of the President's 21-member Labor-Management Advisory Committee this week (April 3). The tri-partite committee of labor, management and public members—headed by Labor Secretary Arthur J Goldberg—plans to meet the first Monday of each month to "exchange views" on a broad list of national problems, and to try for a "consensus" in order to make recommended solutions to the President. **Unemployment, sound wage and price levels,** better collective bargaining procedures—these are among a monumental list of topics handed the Committee by the President at its opening session two weeks ago.

Kennedy asked the Committee to "give direction" to wage and prices, though he did not spell out how this might be done. Goldberg has emphasized the Committee will not seek controls over wages or prices, nor will it become involved in specific labor-management disputes.

NOW BULLARD PRICED LOWER!

NEW Bullard Mult-Au-Matic Type "M"

Contrary to the general upward trend in the cost of new plant production equipment, The Bullard Company is offering the *new* Type "M" Mult-Au-Matic at a price which is *lower than competitive methods.*

Designed and built according to exacting Bullard standards, the *new* Type "M" Mult-Au-Matic incorporates many new features of rigidity, accuracy and productivity which have made this machine famous the world over.

For complete information on the *new* Bullard Type "M" Mult-Au-Matic, call your nearest Bullard Sales Office or Distributor or write to

The Bullard Company, Bridgeport 9, Conn.

TRENDS

DETROIT...

Sales still rise . . .

For March to leave like a lion is sometimes desirable. A buying splurge during the third 10-day period shot the sales rate up to 17,900 cars daily. It had been malingering at a 15,000 unit pace.

However, the increase is not enough to put the industry back on its usual plateau of 6,000,000 cars annually. A simple calculation shows that to reach this total, about 19,500 cars must be sold on each of the 307 selling days in the year.

On a yo-yo . . .

The consumer these days is becoming an increasingly unpredictable boss. A few years back he wanted chrome, horsepower and leg room. It was delivered and turned down. Then the call was for economy and compactness. It, too, was delivered, but there are indications that this alone was not enough.

Every compact maker has rushed into production a luxury-type compact. Corvair has its Monza in two- or four-door form and with it you get imitation leather upholstery and bucket seats for $213 extra. Ford shortly after introduced its "Futura," and Comet countered with the "S-22". The list is almost endless.

But all of these, despite their luxury, still have low performance engines. To fill this gap, Buick and Oldsmobile came up with V-8's causing Pontiac, Valiant and Lancer to offer optional hot-rodded versions of their engines.

Thus this corner asks if you are familiar with that little Philippine toy called a yo-yo that winds up and down on a string? U S automakers are doing the spinning and their customers are manipulating.

For example . . .

It has been decided that maybe existing compacts are too small. So, for 1962, both Ford and Chevrolet have in-between models scheduled. The two Fords, coded "Canadian X" and "Canadian Y", on their 115-inch wheelbase will fit between the Falcon and Ford, and the Comet and Mercury respectively.

The similarly dimensioned Chevrolet "H-35" will offer a choice of a husky 4-cylinder engine, or a peppy six, that interchange many of their reciprocating parts.

Reason for this: Tooling is set up so that either the 4- or 6-cylinder block and head can be machined on the same line with less than a 2-hour changeover time. This tooling will be delivered by June.

On the confusion front, it has also been almost decided that maybe existing compacts are too large. So Ford is gestating a Volkswagen-sized vehicle called the Cardinal. Unlike the German phenomena, though, the Cardinal has a front-wheel drive, powered by a V-4, liquid-cooled engine. It is expected to appear after test-marketing overseas, a procedure that may delay it until spring of 1962.

Studebaker, which once planned a new model in this mini-category, has temporarily shelved the idea. Development work on the 4-cylinder engine, though, is continuing for possible usage in the Lark. As in the Pontiac "Tempest", this would be the current V-8 block sliced lengthwise in half.

Seagrave Corp., old-line maker of fire apparatus, has officially abandoned (*AM/MM*—Mar 20, p63) its plans to manufacture a baby car. The incoming president, Arnold A Soltzman, took one look at the company's $300,000 net for the year and decided such an ambitious project was not for him.

Most interesting of all the newcomers are Ford's and Chevrolet's 115-inch wheelbase models. Actually, these are not much smaller than the standard-sized low-price car of a few years back. And they will be similar in their abandonment of fully wrapped around windshields and dual headlights.

Raison d'etre is simply that there is no longer much demand on the market place for the austere 119-inch wheelbase car. Even salesmen do not need this much space, and if families want the room, they tend to buy the deluxe model.

In addition, Chevrolet plans to use the new wheelbase for a sports model to compete with the Thunderbird.

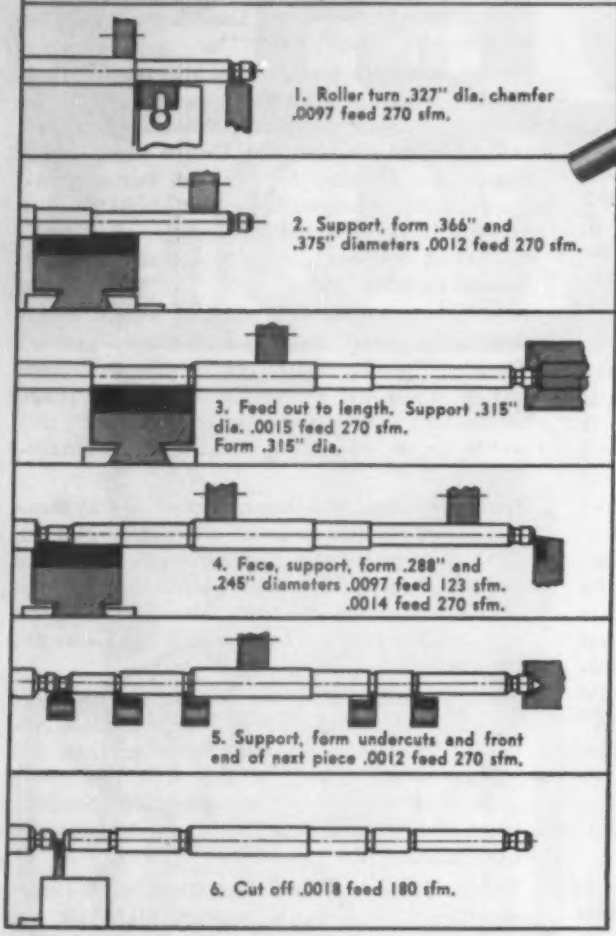
The medium price field, which has already lost DeSoto, will remain pretty much static, design-wise. No new engines are slated for 1962 and the same basic body shells will be used by all makes.

In the upper registers, there is concern only for the future of Imperial as a separate design. Chrysler closed the plant making these, and it is unlikely that further production of this chassis model can be integrated with the unitized lines of other Chrysler plants—**Don MacDonald**

GREENLEE AIR-FEED AUTOMATICS BENEFIT "ELECTROLUX" FOUR WAYS . . .

MACHINE . . . 1"-6 Automatic Bar Machine Air-Feed — Feedout on index and in 3rd position during machine cycle.
TOOLING . . . Carbide Tipped
MATERIAL . . . 1137
STOCK SIZE . . . 13/32" rd.

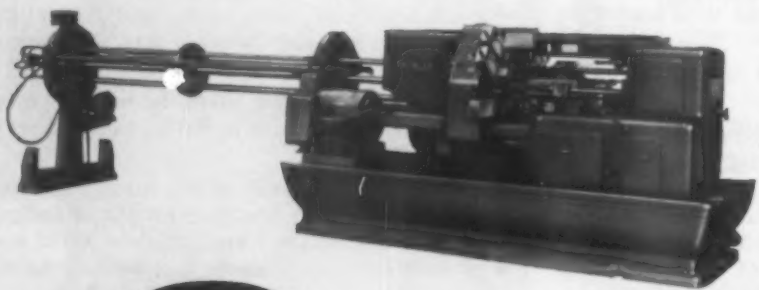
TOOL SLIDE STROKE . . 1-9/16" at .0097" feed.
SPINDLE SPEED . . . 2540 rpm 270 sfm.
MACHINE TIME . . . 5.8 seconds.
ESTIMATED GROSS PRODUCTION . . . 620 per hour


1. Roller turn .327" dia. chamfer .0097 feed 270 sfm.
2. Support, form .366" and .375" diameters .0012 feed 270 sfm.
3. Feed out to length. Support .315" dia. .0015 feed 270 sfm. Form .315" dia.
4. Face, support, form .288" and .245" diameters .0097 feed 123 sfm. .0014 feed 270 sfm.
5. Support, form undercuts and front end of next piece .0012 feed 270 sfm.
6. Cut off .0018 feed 180 sfm.

1. Eliminate stock pushers . . .
2. Eliminate scoring of stock . . .
3. Reduce downtime during set-up . . .
4. Provide extra length feed-out . . .

The part is a 6-7/8" long armature shaft used in the "Electrolux" vacuum cleaner. It demonstrates how effectively Greenlee Air-Feed Automatics and carbide tooling can team-up to increase production and reduce costs. The shaft is machined from 13/32" S.A.E. 1137 steel at a gross production rate of 620 pieces per hour. Recommended cutting speed for high speed tooling is 120 sfm. The rate was boosted to 270 sfm with carbide-tipped tooling. Sequence of operations is shown at the left.

Note how the stock is partially fed out on the index and to its full length in the third position. This provides for the most effective tooling arrangement. Greenlee Air-Feed Automatics permit greater job versatility and assure added profits. See your Greenlee representative or send us a print of your high-cost problem-part.



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PRODUCTION MACHINERY
GREENLEE BROS. & CO.
SINCE 1862
1975 MASON AVENUE
ROCKFORD, ILLINOIS

COMMERCIAL CASTINGS
TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS

AIRCRAFT and MISSILES... TRENDS

Lockheed lands big contract . . .

After locking-up a $1-billion contract in a matter of 46 days, Lockheed's Georgia Div (Marietta) is pushing for early production of 130 new C-141 jet transports for the government's Military Air Transport Service. The awarding of the contract, called the "quickest handling of a major airplane building contract in the history of the Air Force" by a Lockheed source, is expected to give the entire economy of the southeast a "tremendous" boost during the next few years. Some 2,000 jobs are scheduled to be added at the Lockheed plant alone by 1963, and terms of the contract call for at least 50% of the work to be subcontracted.

Lockheed was able to underbid Boeing, Douglas, and Convair and win the speedy award because approximately 85% of the engineering—including design, tooling, jigwork, etc—already in use for production of the C-130 air transport at Lockheed will be used in the manufacture of the new C-141. With most of the initial costs and overhead already written off, Lockheed nailed down the contract in record time.

The new C-141, a big-daddy model of the Hercules C-130, will have a non-stop range of 3,000 nautical miles with a full 60,000-lb plus payload or 5,500 nautical miles with a 20,000-lb plus cargo. In the 600-mph class, the 144-ft plane has a full-width, rear-loading ramp capable of heavy cargo drops or jumping 200 fully-equipped paratroopers. Powered by four Pratt & Whitney turbofan engines the large carrier needs less than 6000 ft of runway to get off the ground.

Explaining the $1-billion contract figure, a Lockheed spokesman said, "They aren't just talking about $1-billion worth of U.S. military airplanes. This figure includes a whole support system including American military planes, American commercial planes, and military and commercial planes for sale to friendly nations . . . the 1-billion estimate also includes spare parts, radar equipment, overhaul equipment, and special cargo handling facilities." Putting down rumors, he went on to say, "Don't believe a word about the airline's apathy toward the C-141." At least three or more cargo-handling-conscious airlines are said to be seriously interested, and are just standing by until the development program gets into high gear.

As of now, the program is still in the design stage with first deliveries scheduled for late 1964 or early '65, but Lockheed is moving ahead to utilize the $30-million provided in the present fiscal budget and is laying plans for the $98-million slice alloted for fiscal '62.

USAF revamps R&D and production

The Air Force has started a massive overhaul of its contracting agencies to simplify and centralize management of major weapons systems. Plans call for a merger of R&D and production responsibilities under a new "Air Force Systems Command", with ARDC and AMC to be abolished as separate entities.

The reorganization reflects the view of many Air Force planners that R&D and production phases of missile, space, aircraft, and electronic projects are no longer clearly distinguishable. According to many critics, the ARDC-AMC division of responsibilities has resulted in "chain-of-command" confusion, delays in pushing new projects into operation, and other frustrating red-tape bottlenecks. Under the new AFSC, contractors will deal with only one agency, regardless of their project's status, eliminating many of the present two-agency problems.

The new systems command will be built around the ARDC. Headquarters will be located at Andrews AFB, Md, with former ARDC commander Lt Gen B A Schriever as head man.

In place of the AMC, a new "Air Force Logistics Command" will be set up at Dayton under Gen Samuel E Anderson, former AMC head. The new command will handle procurement of common-supply items and spare parts—as contrasted with weapons systems—and general supply management tasks such as distribution and warehousing.

Under the reorganization, contracting for basic and applied research, now handled by ARDC, will be assigned to a new "Office of Aerospace Research" under the USAF Chief of Staff.

Bullpup missile costs cut 50% . . .

The Navy's dollar is buying twice as much today than it did in 1958 at the Martin Co. A new $14-million contract with the company's Orlando (Fla) Div will supply Navy, Marine, and Air Force planes with 50% more Bullpup missiles than the same amount of money could have bought two years ago.

The actual number of missiles ordered was not disclosed but under the new contract one Bullpup will cost 57.3% less than when production began in 1958, or, as a spokesman put it, "far below the normal industry cost reduction curve."

"The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

Here's why Lufkin's indicator is the most sensitive!"

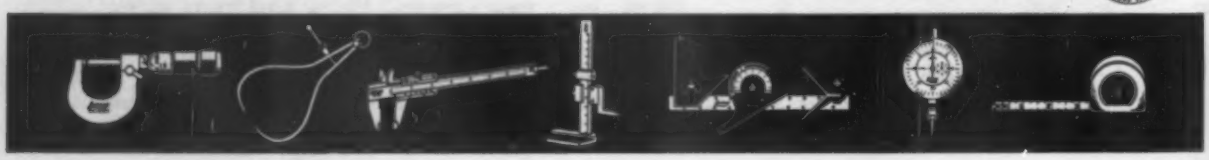
It is made with the precision of a fine watch, with jeweled bearings for longer life.

Lufkin's V32 Dial Test Indicator has a 180° contact point swivel. The dial has clear, easy-to-read graduations to .0001". . . and a switch lever for full reverse action.

Exclusive ball-bearing mounting reduces friction, assures greater accuracy—an excellent example of how Lufkin leads in precision-tool design.

Mount the V32 on a Lufkin Miti-Mite Holder with its rigid (5/16") center post and you have a vertical testing setup that will stay firmly in place. (There's a permanent magnet in the base with a 50-lb. pull.)

See your industrial distributor. He knows precision tools and can show you how Lufkin leads in design and craftsmanship. His stock is maintained to fit your needs. See him for prompt and reliable service. LUFKIN, Saginaw, Mich.



MACHINE TOOLS... TRENDS

Japanese market draws attention . . .

Many machine tool builders have substantial orders for delivery to Japanese customers. Japan as a market is attracting much attention from U. S. builders. A number of prominent builders have plans for visiting Japan this spring.

Average hourly rate in European plants of U. S. automobile makers is about $1.08 in Germany and $1.20 in Britain (including fringe benefits). Hourly rate in France is estimated at $1.12. **Labor supply in Germany is so tight** that some machine tool builders are offering bonuses up to 50 cents an hour to their better workers to keep them. Unions apparently do not object to this practice, because they negotiate only a minimum rate for their members.

British hold back plans . . .

Plans of British car makers to expand facilities to 2½ million or more cars a year are being held in abeyance. No programs are being cancelled . . . they are being stretched out.

Vauxhall has acquired land for a new plant at Merseyside (Liverpool) but instead of going ahead with plant construction will wait awhile. Just how long the delay will be depends on when the automobile industry's sales get better. Vauxhall's situation is typical of other car manufacturers.

India interests U S builders . . .

India is arousing much interest among U S machine tool builders who are willing to license Indian companies to make their machines.

Main reason is that the Indian government has ruled out the importation of machines of types manufactured in India. Thus, U S builders stand to gain important royalties from a licensee who is in a protected position.

Not long ago Bullard licensed Kirloskar Brothers Ltd to build certain of its machines. Ex-Cell-O has a plant of its own in India. Two prominent American machine tool builders are eyeing Indian licensing agreements.

India's machine tool requirements last year are estimated to have totaled $52.5 million. Imports are put at $33.8 million, or about the same as in 1959. $11.6 million came from Germany, $8.4 million from Britain and $5 million from the United States.

Export orders for notching presses . .

Thanks to upgrading of production methods abroad, foreign orders for notching presses received by Hudson Division of Emhart Mfg. Co. have exceeded $500,000 in 1960. Another $500,000 is expected in 1961.

One Indian user bought 17 machines totaling $200,000. France, Japan, Brazil, Portugal and Mexico are the other countries represented among buyers. New orders are anticipated from Spain, Japan, Egypt and South Africa.

Germany going full tilt . . .

Germany is the only West European country whose automobile industry has not yet been hit by a recession. Its automotive expansion plans —Opel, Ford and Volkswagen—are proceeding fullsteam. The new small Ford car for which production is being tooled at Cologne, Germany, may not even be assembled in this country. Tooling is for relatively low volume by American standards . . . and Ford people feel that the main market probably is in Europe and world markets outside the United States.

Opel is tooling a brand-new plant at Bochum in northwest Germany as part of its expansion program. No more manpower is available at Russelheim, Opel headquarters. Bochum is in the heart of a so-called distress area (if there are any in Germany).

A considerable chunk of the Opel tooling orders went to West German builders who can find places in their schedules for reasonable delivery dates when they want to. It all depends on how badly they wish the particular piece of business. German prices, incidentally, are reported to be about the most flexible anywhere in the western about the most flexible anywhere in the west.

Export policy inquiry ordered . . .

Secretary of Commerce Hodges is ordering a full review and evaluation of Commerce Dept procedures in approving or denying export licenses to Iron Curtain countries.

Hodges' action stems from the government's on-again-off-again rulings on a license for Bryant Chucking Grinder Co to ship ball-bearing machines to Russia. (*AM/MM* Mar 20 '61, pp 115 and 122).

Meanwhile, Commerce Dept officials are said to be giving more weight to Pentagon views on whether shipments should be authorized for export.

No more scrap aluminum

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MATERIALS...

Thermoelectric boom?

Metals and other materials useful in thermoelectric devices, now largely in aerospace and defense equipment, soon will have a substantial market in practical consumer products. Key authorities at the Institute of Radio Engineers expressed this opinion at the opening of the Electronics Exposition in New York's Coliseum last month.

Stressing that the whole new science of electronics, particularly the solid state, semiconductor areas, is intimately related to materials and to pure metals, alloys, and intermetallics, John F Byrne of Systems Research, and VP of IRE, said that theoretical metallurgy is laying the groundwork for the future.

Forty watts, or more, of electric power being generated at one striking exhibit was being used to operate a toy train. Its source? A thermoelectric generator, probably containing tellurium and bismuth, heated by a propane-gas flame.

Gallium arsenide . . .

If the IRE exposition can be considered a sounding board, you'll be hearing a great deal more about the relatively new transistor material named gallium arsenide. Texas Instruments Co prefers gallium arsenide to germanium or silicon for transistors. Raytheon Co showed a new pre-amplifier, using this material, which will increase radar range 50%. And a spokesman for Micro State Electronics Corp of Murray Hill, NJ, said that both single crystal and polycrystalline forms were available, the latter selling for eight dollars a pound. By a modified process, Monsanto can produce 600 to 800 gram polycrystalline gallium arsenide ingots in lengths up to 15 in.

Materials for electronics, however, will not be priced by the ton. While, compared with historical mechanical-application purchases, quantities will be fairly small, dollar volume will be extremely large. Values will be in selection, precise preparation, sometimes rare materials, and more technical service by the supplier than ever before.

Rhenium-molybdenum alloys now are in commercial production at Chase Brass & Copper Co, Waterbury, Conn. For electronic, electrical, and aerospace uses at a lower cost than pure rhenium, the alloy is about half moly. Wire 0.1 in. in dia sells for $28 per ft in the 50-50 alloy vs $65 per ft in pure rhenium.

Price reductions of up to 15% for pure rhenium and up to 80% for rhenium-molybdenum alloys will be given to users of significant quantities. Chase, which first produced wrought rhenium, describes this development as significant in providing a high-strength, high-temperature alloy having good ductility. The latter permits fabricating or forming either cold or warm. Ductility is retained to cryogenic range.

Latrobe buys foundry . . .

Sign of the growing interest in casting tool, wear-resistant, and other specialty alloys is the recent purchase by Latrobe Steel Co, Latrobe, Pa, of Cast Masters, Racine, Wis, a development foundry. The foundry specializes in producing large precision castings for the pattern-making and tooling fields; *ties in perfectly with Latrobe's acquisition of a license to use the Shaw casting process.* Latrobe expects to participate more actively in casting precision tooling.

Metals growth keyed to marketing . . .

"Almost any metal you can name is hungry for new and expanded uses—and research programs are being pushed more and more to accomplish this." This is the metals situation as it appears today said R. J. Lund, assistant technical director of Battelle Memorial Institute, at the SAE National Automobile Meeting in Detroit.

But a reversal of recessional trends, increased economic activity in Europe, and political upheavals in various parts of the world could result in far-reaching effects. Some of our present abundance depends on the areas of the world now in, or close to, tumult. However, secondary sources are fairly good.

For iron and steel, Mr Lund has difficulty visualizing any substantial change in availability or price in the next decade. Ore reserves are ample, even from North America, if necessary. Revolutionary technical developments have resulted in lower production costs and expanded capacity. Increased demand should be readily met and the competition of other metals can be expected to hold prices at present levels.

Capital costs of the huge expansion of capacity thought necessary for aluminum will be a severe burden on the industry. However, new reduction methods scheduled for large pilot plant tests in Canada and Europe in the next couple of years might ease this financing load. Short of this source, the industry may be caught in a price squeeze between the need for more income and the pressure of competition from other materials. Unless the Cuban attitude throughout the Caribbean area, high-grade ore should be in plentiful supply.

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14

reasons to consider tape-controlled Gilberts

Summarized here are the main reasons you should consider Cincinnati Gilbert's numerically-controlled 4" and 5" horizontal boring mills. We suggest a letter or phone call for complete information—or, better yet, a visit to the plant to see an actual demonstration. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, phone Kirby 1-4815, Cincinnati 23, Ohio.

GILBERT

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking picture brightens . . .

Increasing orders for durable goods, rising production of steel, renewed optimism on the part of automakers—all this adds up to a brightening picture for industry in general for many segments of Metalworking.

Steel production continues its slow creep upward. Many observers feel that it is already too late for the auto industry to help steel; any improvement must come from other industries, especially construction. No one is willing, at the moment, to predict how 1961 will wind up.

Automakers are stepping up production in April, but only moderately. Preliminary plans for April call for 415,000 cars, about 10,000 more than the indicated March output.

Auto parts producers report that they have had the first inkling of a change in auto sales. Orders are not flocking in, but recent weeks have shown a reversal of the downhill trend in the auto parts industry. Producers have built up some inventories to keep their plants operating, and these inventories will have to be worked off somewhat. But increased orders will be reflected in increased man-hours, spokesmen say.

Major home appliance manufacturers are saying that 1961 looks good. The latest month's sales showed considerable improvement. One large manufacturer attributes much of its improved picture to cost reductions made during latter part of '60 and so far this year.

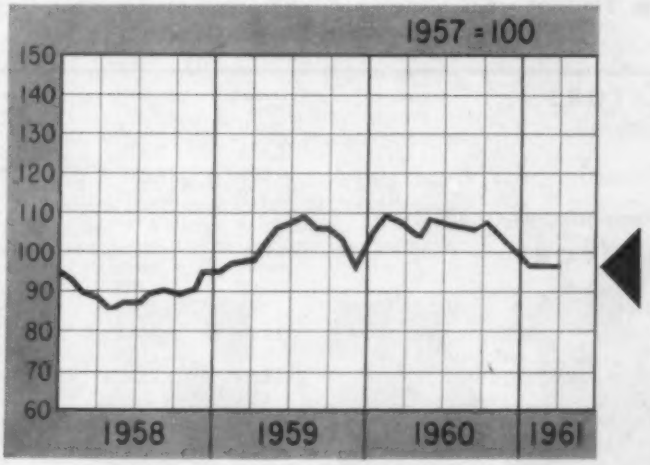
Commercial heat treaters are operating at a slow pace, and they attribute this to low steel production and consumption. Operators report no signs of a pickup, but they do expect a gradual increase when the rest of the economy picks up. They are optimistic on second-half business and expect the year to balance out with 1960.

Sheetmetal shops are operating at a lower level than at this time last year. Shops tied to the construction industry are quite optimistic, but most others must wait upon a pickup in steel and auto production.

Platting shops report very slow business, with one shop reporting sales down 40% compared to a year ago. The picture for 1961 is not good; the expectation is for 1961 to be 10-20% below 1960. Hardest hit are shops tied to the auto industry. Even those that work mainly for the electrical and electronic industries say that business is down.

Orders for materials handling equipment continue to rise, according to the Materials Handling Institute. The latest monthly index, 116.24 (1959-100), is six points above the previous month. This pickup was expected later in '61.

Drop forgers report some improvement in their activity in recent weeks but the operating rate is still holding at about 51%. There are no indications of any loosening up of orders as a result of DOD hardware demands, but increased military procurement should eventually bring in a good bit of business. For this reason, the forgers are quite optimistic about the balance of the year despite its low start.

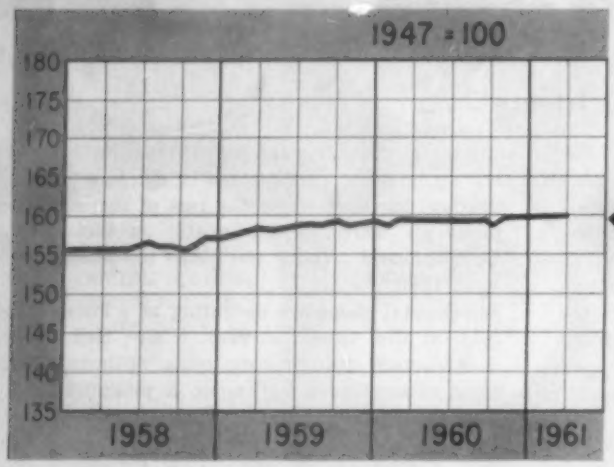


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	MAR Estimated	FEB Preliminary	JAN Revised	MAR Year Ago
Total Index	**97**	**97**	**97**	**108**
Machinery	95	95	95	104
Electrical Machinery	110	109	109	115
Autos	85	88	88	126
Other Transportation ..	89	89	89	88
Other Metalworking ...	102	103	103	111

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	MAR Esti-mated	FEB Pre-liminary	JAN Re-vised	MAR Year Ago
Total Index	**159.4**	**159.5**	**159.6**	**159.7**
Metalworking Machinery	195.0	195.0	189.7	
Other Machinery exec. Electrical	173.8	173.7	172.8	
Electrical Machinery	158.6	158.7	162.4	
Fabricated Metal Products	147.1	147.3	148.0	

Signs of an improving outlook . . .

Evidence of an approaching end to the current business slump continues to mount. And key sectors of the economy have begun to show new signs of life.

The durable-goods-producing sector is a good example. According to preliminary calculations by the Commerce Department, both the sales and new orders of durable goods manufacturers showed a slight improvement in February.

True, one month's improvement in sales and orders taken by itself doesn't herald an upturn in the general economy. But combined with other favorable developments it supports the case for a brightening business outlook.

Retail sales, too, increased slightly in February. Again, the gain—roughly 1%—was not impressive. But both durable and nondurable goods stores saw their sales rise during the month. And the gain in sales to consumers came despite a drop in personal incomes recorded for February.

Coming while incomes were dropping off, the increase in retail sales is encouraging evidence of vitality in the key consumer sector of the economy. It suggests that an actual rebound in personal earnings will be accompanied by substantial gains in outlays for consumer goods and services.

Consumers also appear to be displaying renewed interest in the housing market. For the second consecutive month, the number of new housing units starts showed an increase in February. Moreover, there are clear indications that President Kennedy's efforts to cut long-term interest rates and thus lower the cost of borrowing home-building funds are achieving their objectives.

Even with recovery, however, most forecasters are agreed that unemployment will continue to be a thorny problem to the economy. That's why they now emphasize the need for government and business policies that are aimed at boosting the economy over the longer run.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index *of Activity* (1947-1949=100)*	140.9	141.3	156.7
Steel ingot operation (thousands of tons)	1,574	1,573	2,607
Electric power output (million Kilowatt hours)	14,295	14,353	14,109
Production of automobiles	70,918	91,202	145,852
Engineering construction awards (Eng. News-Record—thousands)	68,510	70,473	67,411

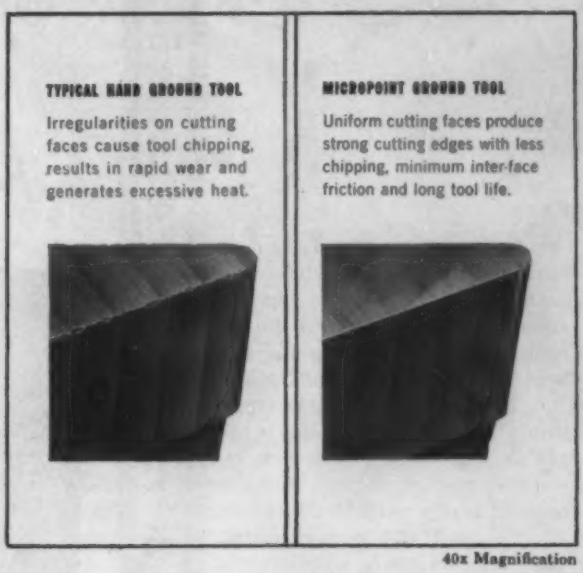
MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1957=100)*	102	102	110
Index of durable manufactures production (1957=100)*	95	95	109
Durable goods manufacturers' sales, billions*	13.26	13.62	15.45
Machinery manufacturers' sales, billions*	4.67	4.58	4.80
Durable goods manufacturers' new orders billions	12.49	13.33	14.06
Machinery manufacturers' new orders, billions	4.24	4.59	4.42
New Orders for Nonelectrical Machinery (1950=100)*	166	159	172
New Contracts for Industrial Construction (1950=100)	163	190	129

* Seasonally adjusted

special report from Fair Street ..... ONE OF A SERIES ..... on cutting tool geometry

how quality of the cutting edge drastically affects single point tool life, part size and surface finish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Uniform cutting faces produce strong cutting edges with less chipping, minimum inter-face friction and long tool life.

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MICROPOINT ASSURES SMOOTH SURFACE FINISH AND STRONG, EVEN CUTTING EDGE

Well over 90% of the power expended in a single point cutting tool operation goes into heat.

To combat the effects of this heat, almost all new cutting tool developments have been directed toward higher resistance to, or better control of, thermal conditions. The goal is longer tool life at higher speeds and feeds, more effective machine tool utilization.

One of the biggest factors in the generation of excessive heat is opposition to chip flow because of interface friction. Also a major factor in the generation of excessive heat is the serrated cutting edge often found at the junction of the top face and relief face of the cutting tool. This uneven cutting edge (note illustration) is the direct result of improperly ground finishes on the top and side faces of the cutting tool.

PEAKS AND VALLEYS RUIN THE TOOL

One look at the uneven cutting edge and it is quickly apparent that under normal machining conditions, the peaks will soon break off, dulling the cutting edge, erasing the vital relief angle, generating more heat with every revolution and soon ending the useful life of the tool. An uneven cutting edge not only shortens tool life, it also has a drastic effect on part size and surface finish. As emphasized in a previous report in this series, loss of relief angle causes excessive down time for a tool change.

Further study of the illustration will show that there are two basic elements that must be carefully controlled on the cutting edges of a single point tool. First, the top and side faces must be as smooth as possible. Second, the junction of these two faces must be uniform and even. There can be no fragile peaks and valleys to become broken.

To control the quality of surface finish and all other variables that determine a properly ground tool demands a machine capable of great precision. The DeVlieg MICROPOINT Tool Grinder is just such a machine.

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Good for the Unions Too

The anticipated union outcry against tax incentives to spur business investments has begun.

The AFL-CIO high command, meeting at Bal Harbour, Fla, deplored President Kennedy's advocacy of such incentives. They do not want any tinkering with depreciation rates, or other tax incentives, because they regard them as "unsound."

Research people . . .

at the United Steelworkers call any liberalization of depreciation "an ill-disguised attempt to reduce the current rate of taxation on corporations." They observe that "the urgent need today is not for new plants or new equipment but for fuller utilization of existing plants and equipment."

Perhaps the most charitable comment that can be made about the union views is that unfortunately union officials do not seem to understand what liberalized depreciation allowances, or the proposed tax incentives, expect to accomplish. Either that or they are using such criticism as a means for retarding the adoption of new, advanced technological developments.

No one at this point is advocating legislation that would bring on a wave of new plant construction and of additions to the nation's productive facilities. What is badly needed, however, is a substantial tax stimulus to make it profitable for manufacturers, without delay, to make use of the new technology as translated into new production equipment.

If that is done . . .

and the obsolete machines are junked in favor of machines of 1961 design, industry will be able to do exactly what the United Steelworkers are advocating: utilize to the best possible advantage existing plants and equipment.

Consider what has happened in recent years. The rate of technological development has speeded up tremendously. Expenditures for research in new materials, new production techniques and new products (that can be expensed taxwise) have doubled, tripled and even quadrupled. The result is a shortening of the useful life of any new machine compared with a new machine of 20 years ago.

These new techniques are wasted unless put to use. If used, they will produce goods of higher quality and lower cost. They will boost productivity. And remember that higher wages become insupportable unless productivity rises.

Yet today's depreciation rules contain only mild recognition of the desirability of making use of these techniques. They do not allow purchasers of new production equipment to write off their investments within the equipment's useful life, on the basis of today's standards.

This is in sharp contrast . . .

with progressive policies of European countries where manufacturers may amortize their new machines much faster than here.

The vast majority of Metalworking's production equipment is old, obsolete, inefficient and costly to run. The best thing that could happen for industry, the unions and the public is to replace tens of thousands, even hundreds of thousands, of these machines with today's machines. And the best thing that the government could do to hasten this modernization would be to allow faster writeoffs or some other equally effective tax incentive.

Such a tax program might cost the government one billion dollars the first year in revenue. But the beneficial effects would be so far-reaching that before long the government would get its lost revenue back many times over.

It is time that all of us, including union officials, realize that tax incentives to capital investment are not giveaways to industry, are not unsound, but are one of the best ways to stimulate a strong recovery of the national economy.

Burnham Finney EDITOR

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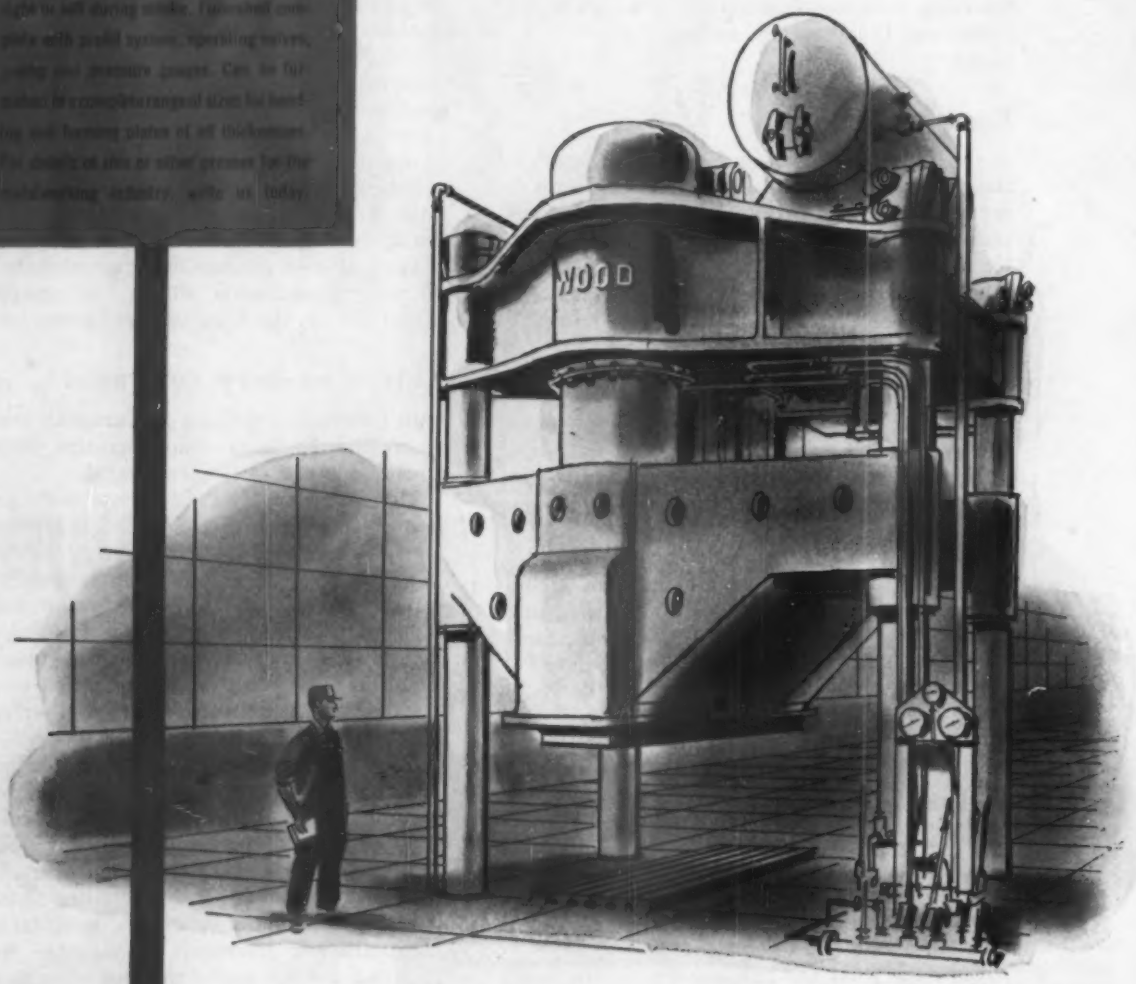

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VOL 105, NO 7 American Machinist / Metalworking Manufacturing APR 3, 1961

HOW TO CUT PLANT ACCIDENTS

Here is a new theory that has paid off in fewer accidents and lower compensation payments. Foremen (not the safety director) are responsible for safety, and people (not machines) are the main concern

By Tom Johnson, associate editor

Too many companies are spending too much time, and too much money, on the wrong aspects of safety.

In a good safety program, the real emphasis should be on people, not on machines. Investing heavily in safety equipment is *not* the most effective way to reduce accidents.

Here is why: Four out of five major accidents are the result of man failure—not machine failure. If only 20% of disabling accidents are caused by hazardous plant conditions or machine failure (always present to some degree, no matter how great the precautions) why shouldn't *people* be the main concern of any safety plan?

This is the new philosophy of the Bassick Co, Bridgeport, Conn, a firm which is fairly typical of the large job shop and which encounters fairly typical metalworking hazards.

Bassick's emphasis-on-people safety program has already produced some striking results since its formal inception in May, 1960. Last year compensation payments to injured workers were only one-third what they were in 1956 (the year in which the company began to think seriously about taking a new look at safety), and accidents have also dropped.

Understandably, Bassick officials are reluctant to claim that the program alone is responsible for the good showing. Even with a near-perfect setup, a series of freak accidents could spoil any safety record.

"Give us another year," they say, "and we'll be able to establish a definite trend. We do feel that we're on the right track at last."

Stressing the human

Underlying the Bassick program is one key assumption: *Most accidents are predictable, therefore preventable.* Behind each accident there is a cause; if the cause is discovered, the accident can be predicted and future incidents prevented. Most of the time, the cause is man.

W C Seatter, director of industrial relations, offers this explanation: "The program is a way of improving safety performance without the expenditure of a lot of money and the time of a lot of people. If fewer than 20% of our accidents are the result of substandard physical conditions, more than 80% would still occur, even if we spent all the money necessary to correct every condition.

"We feel that we can substantially reduce accident losses without taking up the time of a lot of people and spending large sums to eliminate questionable physical hazards. In fact, the elimination of an unsafe act should be at least 60% more effective in reducing accidents than elimination of an unsafe condition."

Naturally, the company does not ignore physical hazards. All machines are adequately guarded, and specific danger areas in the plant receive prompt attention. What the new program does is shift the emphasis to where it belongs—to people. The whole program, in fact, can be considered "preventive maintenance of people."

Key features

Any company program that stresses people must have a firm set of ground rules. For unless every person clearly understands his respon-

HOW TO CUT PLANT ACCIDENTS

sibilities, the program will be ineffective from the start. Here are the main features of the Bassick setup:

- The company is *organized* for safety. A formal system (see organization chart) ensures that every facet of safety is systematically analyzed—at regular intervals.
- A statistical approach helps point out the key areas in which safety needs to be stressed.
- The individual foreman—not the safety director—is responsible for training workers in safety practices, and seeing that workers obey regulations.
- Each worker is responsible for strict observance of safety regulations. Violations can bring disciplinary action—even dismissal.

Old safety program

The world's largest manufacturer of casters (thousands of types), Bassick normally employs some 800 production workers in its four separate but close-together Bridgeport plants. Each plant has a large punchpress section (sizes range from 500-ton hydraulics down to small kick or bench presses). In addition to standard machine tools, there are conventional lines for plating, rolling, and heat treating. Safety problems are typical rather than extraordinary.

Before installing its new program, the company had a safety history that also was typical of those in many other companies. As far back as World War II, safety was (vaguely) the responsibility of the plant manager. Loosely administered, the program never really got off the ground. And the accident rate was high.

In 1947, management reacted to a soaring accident rate by creating a safety director. Actually, the new position was filled by a plant supervisor. What happened was what might have been expected: Foremen used the safety director as an excuse to get rid of their safety headaches. And the director, charged with investigating the cause of accidents, perhaps naturally tended to place the blame on a machine rather than a worker.

In 1956, the Industrial Relations Dept began a series of meetings with supervisors, to discuss general safety principles. Here the intention was to discuss with foremen their safety responsibilities. The department quickly discovered that the foremen were not interested in talking about safety principles, but about specific problems: a hole in the wall, greasy floorplates, and the like.

What these supervisors couldn't seem to grasp was that there will always be hazards in every plant, that supervisors do not escape their duties simply by bringing specific hazards to the company's attention. Helpful, the meetings were not helpful enough.

Now the company created a four-man safety inspection team. Meeting once a month, the team made a complete tour of each plant, listing all unsafe conditions it found. After an item had appeared for three months in a row on the list, the team met with a foreman to find why the condition had not been corrected.

This latest safety plan was not very successful. As the months passed, the team's list grew longer. Some foremen resented the team and did little or nothing to help; others were frustrated trying to get all the conditions corrected at once. Many changes recommended by the team were simply too expensive to adopt. The result: The team spent a lot of time and money doing almost nothing constructive. Eventually, the team was dissolved.

The next move that the company made was a step in the right direction. In 1958, plant safety rules were completely revised, and a new safety booklet was issued. Although the new booklet contained general plant safety rules, it also included something new. For each plant department, there was a set of special rules, *written by the supervisors in the department.* In insisting that supervisors generate their own rules, the company in effect was transferring safety responsibility from the safety director to where it belonged: with the plant supervisors.

Organization

The organization chart on p 83 shows the new setup. As the chart reveals, safety at Bassick is the business of everyone—from the company president to the individual worker.

Six separate groups share duties:

- **The Loss Control Committee.** This group (the company president is chairman) establishes overall safety policies and evaluates the program's effectiveness. Meeting quarterly, the committee examines a basic guide, the "Compensation Loss Experience Report," prepared by its workman's insurance company (here, Traveler's Insurance). This report, which shows total compensation payments to injured workers for the quarter, helps the committee to determine if its safety policies are being carried out properly. The committee also evaluates the work being done by other plant safety groups.
- **The Accident Incident Division Staff.** Called AIDS, this group meets monthly to review a statistical analysis of accidents and their causes. Primary source materials are accident reports from supervisors and accident analyses prepared by the safety director and the insurance company.

AIDS' primary responsibility is to examine all incidents that led to accidents, evaluate remedies proposed by supervisors, and take any corrective actions necessary. This group is *not* responsible, incidentally, for detecting and eliminating unsafe working conditions.

- **The Department Safety Committee.** This group works directly with the safety director on special safety problems that come up. Essentially an ad-hoc committee, working under the guidance of AIDS and the safety director, this group is formed to investigate any unsafe act or condition in a department. Then it reports its findings, with recommendations, to AIDS.
- **Foremen.** The key men in accident prevention, foremen and assistant foremen are closest to the conditions that create accidents, as well as to the employees who have them. Thus they are the most effective force in translating safety policies into action. By company order, *they must be prepared at all times to take immediate action to eliminate any unsafe practices or conditions that exist in their departments,* or to report to their superiors any unsafe condition beyond their authority to correct.

These foremen are also responsible for training new workers in safety practices, checking protective equipment regularly, inspecting all job locations, and investigating all accidents to determine the cause. When there is a major accident, a foreman must make out an investigation report for the safety director.

- **Workers.** Each worker is responsible for carrying out every safety regulation that pertains to his work. Under company policy, ignoring vi-

olations of safety rules can bring disciplinary action—even dismissal.

• **The safety director.** Key coordinator of the safety program is, of course, the safety director. His key duties: Maintain accident records and their costs . . . analyze (with the insurance company) accident records . . . furnish AIDS with these analyses and make recommendations for corrective action . . . report all major injuries to the Loss Control Committee . . . prepare and administer training courses in safety.

Thus the safety director is an administrator, not a repairman. Because foremen have on-the-spot responsibility for investigating accidents, he is free to concentrate on the overall safety picture. It is here that his work really pays off.

By carefully examining each accident report, and by compiling statistics that point out the worst safety hazards, the safety director is in a good position to predict (and thus prevent) recurrences of accidents.

Reporting accidents

When there is an accident at Bassick, the worker is immediately sent to First Aid, accompanied by a slip (made out by his foreman or timekeeper) that gives brief details on the accident. This slip is designed for quick filling-in; all the foreman has to do is write a few words and check a few squares.

If there is a likelihood that compensation payments will have to be made, the safety director orders (after the medical examination) the worker's foreman to make a more extensive analysis of the accident. This the foreman does on a special form, detailing the accident, the unsafe condition, and his remedy.

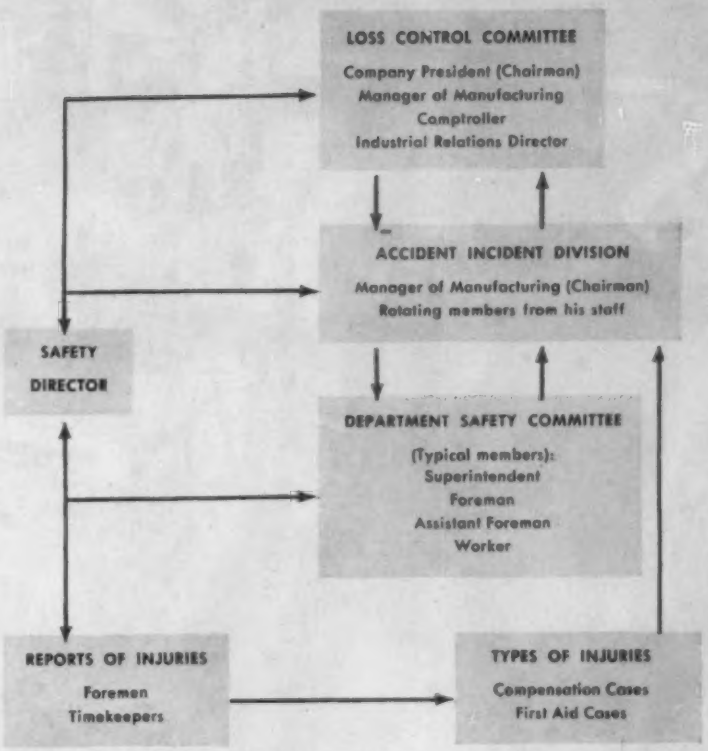
This accident slip is the safety director's basic guide for analysis of accidents. If an injured worker has to be sent home, it also acts as a pass to get him out of the plant. Terminology for accidents is standardized, so that statistics aren't ambiguous.

Predicting and preventing

Just how does the company go about predicting, and thus preventing, accidents? The following is a typical example of what happens:

Suppose that the safety director, while examining his accident records, discovers that several workers have been injured lately while lifting steel coils. Although the injuries have not been severe, he recognizes that the trend could become dangerous.

Investigating, he finds that Production has recently ordered an increase in the size of coils, to get longer runs. Suspecting this change to be behind the injuries, he suggests to AIDS that a special committee be set up to study the problem.



Safety setup at Bassick involves everyone from the company president to the individual worker. See text for details on how this system works to reduce accidents

AIDS, agreeing with the director, orders that a Department Safety Committee be set up; this committee begins at once to look into the matter. From its investigation comes the following recommendation for workers who have to lift coils: "Before loading a heavyweight coil, ask your supervisor for help."

Once the committee has made its recommendation, the new rule goes into effect *at once*, with a minimum of red tape. There is no waiting for approval from AIDS or the Loss Control Committee. And the new rule is carefully explained to all workers affected. Any violation of the new regulation, they are told, will bring disciplinary action.

At the same time, the committee gives its recommendation to the safety director, who communicates it to higher management. At the next AIDS meeting, the safety director reports on the new rule. AIDS reviews the rule and accepts it or makes suggestions for more study.

Just how effective will the new regulation be? Proof will come at the next quarterly meeting of the Loss Control Committee, when it examines compensation-loss figures from the insurance company. Accidents in lifting coils should be substantially reduced.

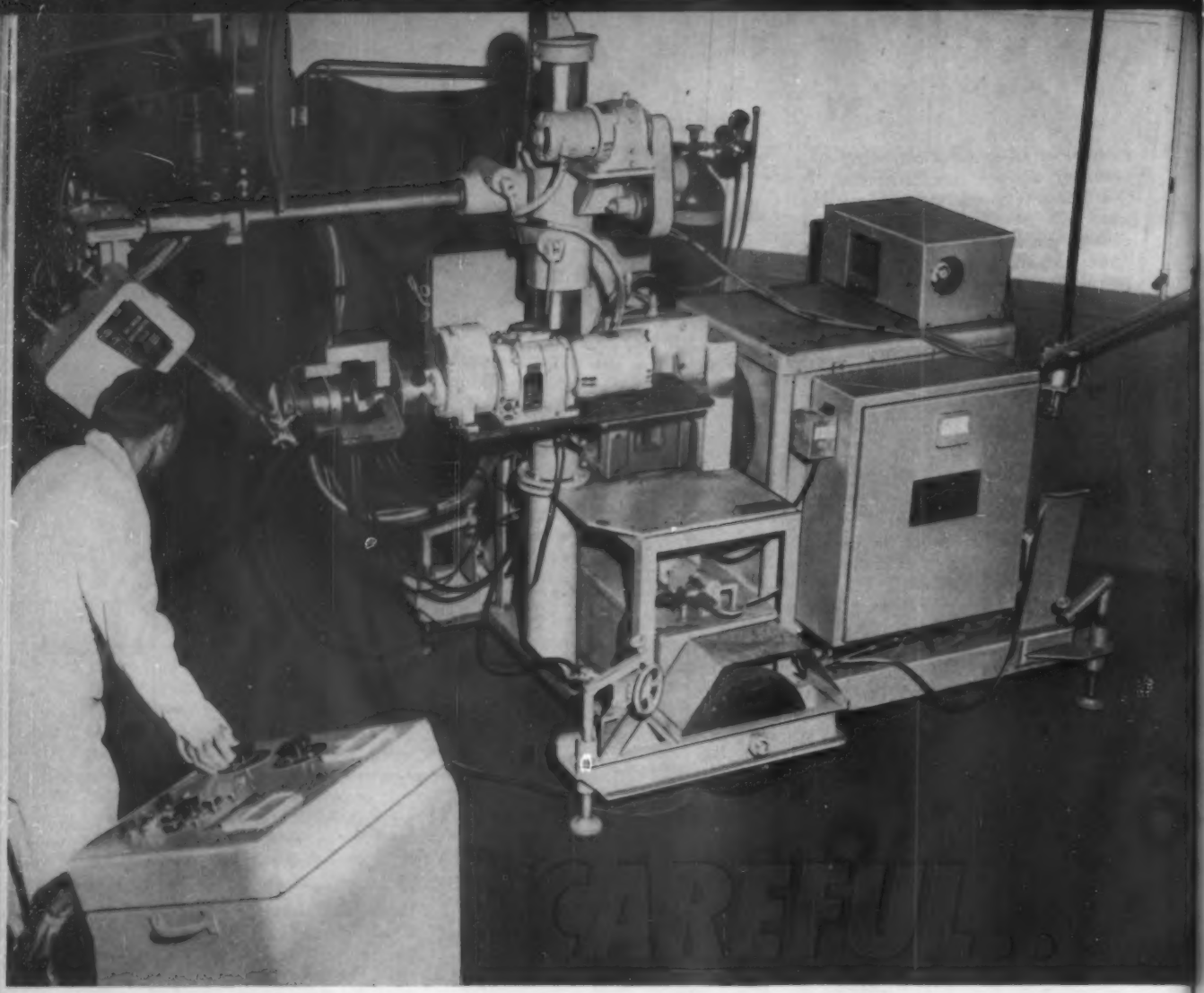
The example just given should have made clear the main assets of the Bassick safety program, which need to be restressed:

• The men closest to the safety hazard, and most familiar with it, are the ones who write the safety rules. They understand their safety duties and know what to do when they spot a substandard condition.

• When responsibility for correcting safety hazards is not dumped upon the safety director, he can actively concentrate on analyses that will pay off in fewer accidents.

• The company is organized to prevent many accidents before they have a chance to happen.

• Finally, and most important of all, the program is effective. As Roswell Harris, Bassick's safety director, puts it: "There is one sure guide to evaluating the effectiveness of a safety program: How much are accidents costing a company?" The significant reduction in compensation payments to injured workers is the best proof that the company needs. •



...it's loaded!

It really *is* loaded, too. The "can" about to be welded above contains solid rocket propellant. Safety and after-weld strength require special techniques and care

By Eugene A French,
Rocketdyne Division
North American Aviation, Inc,
McGregor, Texas

The above workpiece, about the size of a two-pound coffee can, contains extruded ammonium nitrate, which will auto-ignite if it stays at a temperature of about 400 F for five minutes. And the operator is preparing to seal the unit by welding the forward head into the case.

However, before he starts the weld, he will move the portable control console—and himself—behind a concrete wall. There, he can perform the operation by remote control, watching it through either a mirror or closed-circuit TV.

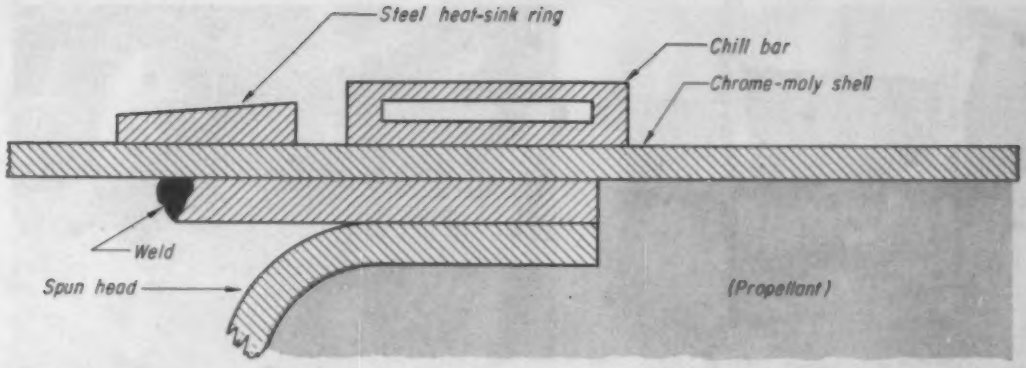
Actually, the "can" is an improved design for the solid-propellant gas generators that start the fuel and liquid-oxygen turbo pumps on large, liquid-propellant rocket engines. The new cases are significantly lighter than the old ones, and they cost about half as much to manufacture.

In addition, they're more reliable; the welded closure makes a better seal than the former screw-on head with an O-ring seal. However, these improvements did not come easily.

Safety was obviously a big problem. The operation would be out of the question if it couldn't be performed effectively by remote control. There was also a serious problem in maintaining the required strength in the case after welding.

In service, each of these turbine starters supplies 1500 hp for one second. This provides the initial power impulse to start the 1,500,000-lb-thrust Saturn boosters and the advanced MA-3 liquid-propulsion system developed by Rocketdyne for the Atlas ICBM.

Originally, they were made with a refurbishable case, machined from heavy steel forgings. However, the O-ring seal on these cases did not



Steel heat-sink ring preserves strength of gas-generator case during welding. Water-cooled chill bar keeps the propellant from reaching auto-ignition temperature but must be properly located to avoid chilling the weld

always prevent gas leakage under sustained back pressure from the liquid gas-generator system.

Lighter and tighter case

Early design studies indicated that a welded closure would not only make a tighter seal but would also permit a lighter weight, disposable case that would be easier and less costly to manufacture. Therefore, the development work on the new welded case began with a length of chrome-moly tubing, machined on the ID and OD.

The aft head, containing the nozzle detail, was designed as a simple machined sleeve-in-plate. This is inserted in the case and copper furnace-brazed.

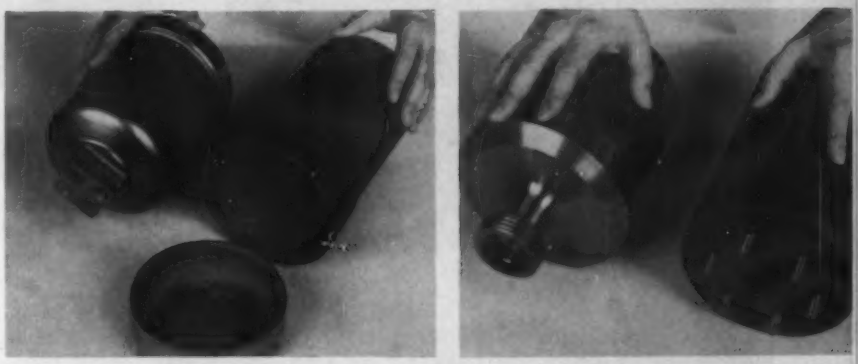
The forward closure is also simple; it's a spun head in the form of a dome with a return flange. An igniter boss is copper furnace-brazed to the inside of it. When installed in the case, the convex surface faces out, and the edge of the return flange is accessible from the outside for welding.

However, as shown in the above sketch, the weld is a lap joint, subject to shear force in operation. In testing, it has to withstand a pressure check of 3500 psi.

Study welding effects

Therefore, it was important to find out what effect welding would have on the strength of the heat-treated case. We made test welds, sectioned them, and took hardness readings at ⅛-in. intervals over the length of the heat-affected zone on the outside of the case.

It was obvious, from low hardness values in the case directly opposite the weld, that the effects of heat treatment had been reduced in that area. This created a soft zone that would be a weak link in the case during operation.



Forward view of old and new cases (left) shows spun head that is welded into place after the case is loaded with propellant. Aft view of the two designs is at right. New unit is lighter, easier to make, and has better seal than old one

Heat sink helps strength

To improve this condition, we designed and tested several types of heat-sink ring. None could eliminate the annealing effect, but several caused a definite lessening of the sharp drop in the hardness curve to a less critical change rate.

The most successful type has a tapered cross section with a width of 1 in. and a height increasing from ⅛ in. to ¼ in. This provides a low mass opposite the weld, increasing to a relatively high mass aft of the weld.

The next problem was how to keep the propellant from getting too hot. We did this by placing a chill bar around the case aft of the heat-sink ring. As indicated above, the chill bar is a copper ring containing a passage for cooling water. The ring itself has a cross section of 2 x ½ in., and the passage is 1½ x ¼ in.

A check of this arrangement showed that the propellant reached a maximum of 130 F about five minutes after the weld cycle ended. The entire unit returned to ambient temperature in about 30 min.

Position is important

But we found that the position of the chill bar in relation to the weld area had a bearing on weld quality. If too close, it caused severe chilling, which produced a hard, brittle condition. It also caused lack of fusion at the root.

However, by locating both the heat sink and the chill bar properly, we were able to make good welds of X-ray quality consistently. In pressure tests of these welds, failures occurred at various other areas than the weld zone, thus demonstrating that the welded closure was adaptable to these cases.

Once this was determined, we needed an automatic welding unit that could be operated from a remote area—in the event the propellant should ignite accidentally dur-

Operator has entire job at his fingertips, even though he is separated from it by a concrete wall. Mirror lets him see what's going on, and he can make all adjustments on console

Completed weldment has cooled for 5 min to make sure it's safe to enter the welding area. Operator is removing steel heat-sink ring. Water-cooled chill bar is still in place

CAREFUL ... it's loaded!

ing welding. Here, the company drew on its experience with welded turbine wheels to design and build a portable remote-controlled Tig (tungsten, inert-gas) welding fixture.

The fixture is equipped with an Airco HMH-E welding head and control and a Graham variable drive with reversing drive and micrometer speed adjustment. Part rotation is 5.25 to 5.75 ipm. Power is furnished by a P&H 400-amp, d-c unit.

Maximum safety area

This equipment has been placed in a maximum safety area with a reinforced-concrete wall to separate the operator from the loaded case during all welding operations. Before making the weld, however, he moves the remote-control console on its casters into the cell for the setup and alignment.

At this time, the weld head is incapable of creating an arc because of a safety interlock, which remains out of the console while the operator is in the cell area.

After checking out the weld head and the alignment, he moves the console out of the area and beyond the concrete wall. Only after the weld area is cleared does he place the safety plug back in the console.

The welding equipment is designed to operate on a double cycle. The short first cycle (3 to 7 sec) establishes the arc and permits final checking for optimum conditions. The second cycle follows immediately and does the actual welding with filler metal added.

First cycle for checking

At the start of the first cycle, the variable-speed drive starts rotating the work, the Tig welding head descends, coolant water starts to flow, and the arc is established at 30 amp. Then, to set the arc length, the operator adjusts the voltage to a predetermined amount (7.0 to 7.3 v) with a micrometer voltage adjustment.

After this, he energizes a motor-driven rheostat that up-slopes the amperage to a pre-set level for welding without filler metal. He adjusts this amperage if necessary, logs it, and checks the welding operation visually.

Second cycle for welding

If conditions are right, he energizes the second circuit, and another motor-driven rheostat up-slopes the amperage to the level that will be required by the addition of filler metal (175 ±3 amp). As the pre-set amperage is reached, the weld wire (0.045-in.-dia Oxweld No. 71) is advanced automatically into the weld puddle at 37.5 ipm.

At this instant, the operator starts timing the operation with a stop watch. As it proceeds, he keeps a close watch on the volt and ampere gages mounted on the remote control console and corrects any deviations.

He also resets the first rheostat to its starting value of 30 amp. Otherwise, it would prevent tapering off the amperage at the end of the weld, which could cause excess heat and possibly burn-through.

Timed to the second

When the operation has run for 3 min ±5 sec by the stop watch, the operator pushes the stop button. The wire feed stops, the current drops directly to the pre-set taper-off amperage (110 amp), and a timed decay of weld heat begins. The decay slopes down to 30 amp, and the machine cuts off the arc and stops the rotation.

A cooling period of 5 min is also timed by stop watch so nobody will enter the cell until the case is ready to be removed from the fixture. Total floor-to-floor time is about 15 min.

More than 50 of the newly designed turbine starter cases have now been welded successfully after being loaded with propellant. The units have been test fired without incident and then subjected to hydrostatic pressures up to 6400 psi without bursting. •

Sales, not propaganda, the aim

East and West Germany dominate Leipzig Fair

By Pete Forbath,
AM/MM Bonn Bureau

The key display of the Communist machine tool industry at this year's ten-day (March 5-14) Leipzig Fair was the order book. For a change the nationalized factories from behind the Iron Curtain resisted the temptation of showcasing advanced metalworking concepts for the sake of headlines as they have done in past fairs.

Stung by charges that as often as not their prototype machines wouldn't—and in fact couldn't—be put on a production basis once the East German-sponsored show was over, the Communist-bloc nations concentrated on showing solid advancement in automation, programming, and standardization.

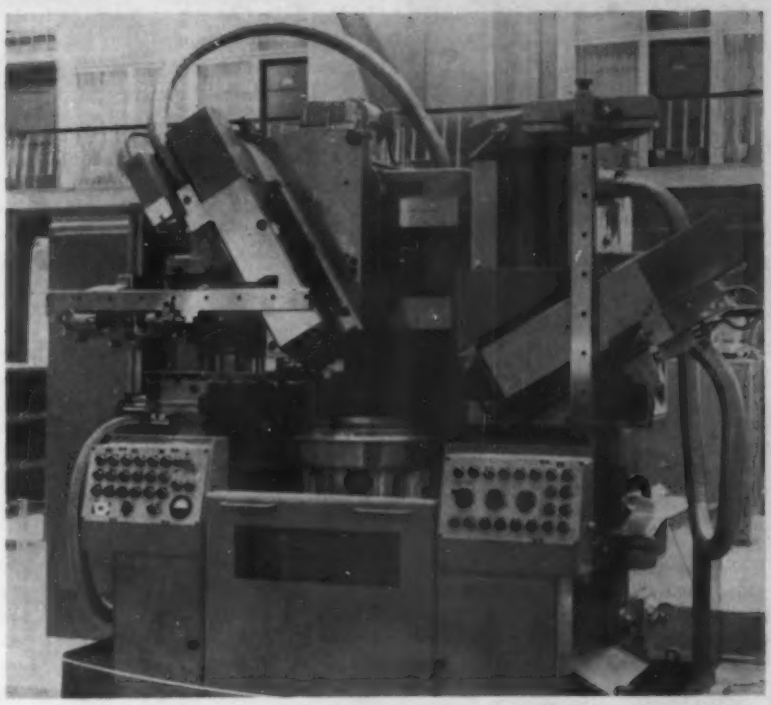
Time and time again, the some 600,000 visitors who flocked to the six-nation (East Germany, Czechoslovakia, Russia, Red China, Poland, and Hungary) machine-tool exhibition were assured that every machine shown was a production model, thoroughly tested in actual factory operation. The Iron Curtain countries were clearly out to demonstrate the reliability and maturity of their expanding industry. Their goal was unmistakeably sales, not propaganda.

In the lead in this sales drive were the East Germans, who once again had the largest machine tool display of any nation. They were represented by about 25 firms showing over 130 machines.

Czechoslovakia, through its trading agency, Strojimport, was in second place among Communist nations with about 50 machines. The Soviet Union's Stankoimport displayed some 30 machines, and the China National Machinery and Export Co showed twelve Red Chinese machines. Poland and Hungary came to Leipzig with about ten pieces of equipment each.

Western participation

Though overall Western participation at Leipzig this year was greater than in 1960, fewer machine tool builders exhibited and those that did booked less space than in 1960. According to some observers, 1961 may mark the beginning of the decline of the Leipzig Fair as a major European machine tool show from the West's point of view.



Czechoslovakian vertical chucking lathe, Type SPK63, with copying attachment, is designed to turn flange-shaped parts up to about 25 in. dia and 10 in. high. Combination of punched cards and stop drums can sequence 36 operations

Great Britain is a good example of what's happening. The fair catalog listed six British machine tool companies as being represented at the fair, but only one, Dowding & Doll, had machines on display. The other companies participated through information booths or tied into the exhibit of their companies' other, related products. These firms maintained that the fair wasn't worth the relatively high cost of shipping machines from England to Leipzig. They were there to put their names on display and to answer "any stray queries that came our way."

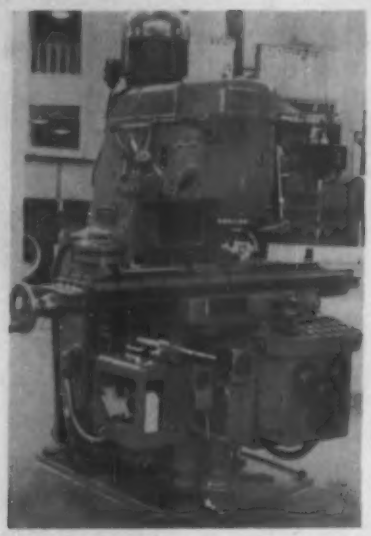
Even Dowding & Doll, which brought eight machines to the show, including the US-licensed, British-built Wiedemann turret punchpress, is inclined to support this view. Alfred Vincent, the company's export manager, comments, "If I have anything to say about it, we won't be making this strong a showing next year—if at all."

Strong showing by West Germany

West Germany's showing, strongest by far among Western nations and second only to East Germany, consisted of some 35 companies displaying roughly 100 machines. This too was slightly down from last year, but this is chiefly because of the brief interruption in the West-East German trade pact last year, which prompted the Bonn government to officially discourage West German firms from taking part in the fair.

The West Germans have a strong compulsion to turn out at the fair. Shipping costs are not high, and East Germany is still a good market for West German machinery. Nevertheless, suggests one West German builder, West German participation has probably reached its peak.

France listed nine machine tool builders as being at the fair. But the majority did not have machines on



Russian tape-controlled miller, Model 6H11KP, is equipped with a copying attachment. Machine appears to use 4-in.-wide punched paper tape. Spindle speeds range from 65 to 1800 rpm, feeds from 0.8 to 40 in. per minute

display. Italy was represented by three companies, Austria and Belgium by two each, and Sweden, Switzerland, and Luxembourg by one each. And the bulk of these firms confined their activities to information booths and one or two simple machines. A group of American steel producers took part in the fair, marking the first participation by Americans in a Leipzig Fair. As in previous years, though, no US-built machine tools were displayed.

Why this lack of enthusiasm?

The West appears to be losing interest because very little machine tool business is transacted at, or as a result of, the Leipzig Fair—at least in a West-to-East direction. True, virtually every Western firm sold some of the machinery it displayed at the fair to East Germany. But this is chiefly because the host national traditionally guarantees to buy some of every type of product put on exhibition.

On the other hand, the Communists insist they did a booming business with the West. The East Germans for instance, claim that their total sales and purchases with the West at the show amounted to nearly $225 million, with machine tools accounting for about $15 million. The Czechs report that they sold every one of their 50 machines by the fifth day of the fair, and the bulk of the business was with the West.

Western observers take such claims with a large grain of salt, and point out that when the Communists talk about business with the West they are including barter deals with underdeveloped nations like the United Arab Republic, Ghana, India, and Indonesia. Notes an American visitor to the Fair, "As far as machine tools are concerned at least, the big business that goes on here is between the Communists and third markets."

Machine tool rationalization

Talk of rationalizing machine tool production among the Communist nations within the framework of the Council for Mutual Economic Aid (COMECON) was markedly toned down at Leipzig this year. The reason is related to Communist stress on the commercial side of the fair.

An East German spokesman provides this clue to the Communist view. "One of our biggest selling points on the world market is that we offer virtually every type of machine tool imaginable. Any potential customer knows that no matter what its requirements are it can probably get them filled in the German Democratic Republic." Another spokesman made it very clear that the Czechs are reluctant to give up manufacturing any type of machinery that can be sold on world markets. The Czechs' stated goal is to move from their present position as the world's third largest exporter of machine tools and overtake West Germany for second place within three years, and begin crowding the United States for first place by 1970.

The Soviet Union has quietly eased itself out of any commitment to a definite machine tool rationalization plan. A top official said, "The USSR builds and will continue to build every kind of machine tool that it needs."

Machines at the show

East Germany, with its 130 machines, demonstrated that it is seeking to push automation as far as is economically possible. Moreover, the East Germans gave evidence that they are committed to the building-block concept and to the idea of linking up standard tools by means of low-cost handling equipment.

About 30% of the East German machines were fully automatic, and another 50% or so were semi-automatic. Virtually every lathe on exhibit featured punched-card programming devices, but not one of the machines shown was tape controlled. Apparently the East Germans feel that punched-card systems are more economical and just as capable as tape systems.

This year the East Germans emphasized forming equipment. They showed a 2500-ton, high-speed forging press capable of turning out 65 pieces per minute. It was equipped with automatic feeder and a high-frequency electrical heater, and was linked to a plate, slab and billet shear. Together, this short link-line can turn out drop stampings of steel pipe flanges at a rate of 720 per hour.

Of all the exhibitors at Leipzig, only the USSR trotted out any elaborate transfer lines. The two machines shown were said to be entirely new, but since they were to be installed in Russian factories when the show closed, they were not for sale. The first unit consisted of nine machines for turning out automobile main crankshaft bearing plates at a rate of 325 per hour. The second consisted of six units for production of car motor oil-filter housings at a rate of 60 per hour.

The Russians also showed a tape-controlled lathe, complete with automatic loading and unloading attachments, that is designed to machine shafts up to 60mm in diameter and 370mm long. [*Ed. note:* This appears to be the same machine that the Russians showed at the Russian Exhibition in New York in 1959, see *AM* —Jul 13, '59, p 105.] Other Russian machines included a tape-controlled vertical miller with copying attachment (photo, top left), a universal miller, a semi-automatic surface grinder, a semi-automatic gear shaper, and an automatic keyway cutter.

Czech vertical chucking lathe

While a Czech tape-controlled miller attracted a good deal of attention, the star of the Czech display was probably the vertical chucking lathe (p 87) designed to turn heavy flange-shaped parts. Also shown in the Czechoslovakian exhibit was a high-precision horizontal boring machine.

The Red Chinese machines were described as modern, soundly designed and built, and just about the same sort of thing the Russians were building five years ago. But there was some question whether the Chinese have any more of the machines than the ones they displayed at the show. Among the machines were a gear cutter, a gear grinder that grinds the flanks of spur and helical gears, and a thread grinder with infinitely adjustable spindle speed and an intermittant compensating gear on the spindle for bilateral grinding. •

Warm-working boosts useful strength of steel

The alloy steels used in rocket casings can, and are, being heat treated to yield strength levels on the order of 200,000 psi. Not many years ago this would have been considered beyond practicability; now the problem is how to double this strength.

Steels can develop such strength, but steel processing technology has not found a way to get around brittleness at these strength levels.

What the missile-part designers are looking for, of course, is the highest possible strength-to-weight ratio in the materials they use for missile hard parts. A relatively new technique known as the Ausform process may help close this gap between materials requirements and their capabilities.

The Ausform process, a thermomechanical treatment that upgrades many alloy steels by imparting ductility at ultra-high strength levels, was described by Stuart T Ross, manager of Ausform and Hard Parts at Ford Motor Co's Aeronutronic Division (Newport Beach, Calif), at ASME's Aviation Conference, March 12-16, in Los Angeles.

Warm-working process

Because deformation generally takes place in the temperature range from 800 to 1000 F, austenitic warm-working is also an appropriate name for this process. In comparison, conventional hot-working such as forging or rolling of steel is done at temperatures well above 1500 F, where austenite is completely stable.

Deformation must occur at a temperature below that at which pearlite forms but above that at which bainite forms. For steels that respond to the process, this temperature range is from 800 to 1000 F. The part is first heated to 1550-1850 F to insure homogeneity of its high-temperature phase, austenite. It is then cooled rapidly into the deformation temperature range.

The part can be cooled by quenching in molten salt or lead, or by air cooling, depending upon the alloy being processed. When the desired temperature is reached, the forming operation must be performed quickly before austenitic decomposition occurs.

Any conventional process—forging, rolling, shear-forming, extrusion—can be used. It has been found, however, that heavier equipment is needed to withstand the greater deformation pressures required for austenitic warm working.

Almost all wrought shapes can be Ausformed. After deformation, the steel part is quenched to room temperature and, if necessary, cold-treated to insure complete transformation. The fully hardened part is then tempered at 200-800 F.

Ausformed steel microstructure differs from that of conventionally quenched and tempered steel in that the martensite plates are only half as long (about 1½ microns in Ausformed steel, 3 microns in conventionally treated steel). Improvements in mechanical properties are attributed to the extreme fineness of the resulting structure.

Deformation influences strength

The strength of all steels is proportional to carbon content. Strength of warm-worked steels also depends upon the amount of deformation (% reduction of area) they undergo. A 0.31%-carbon steel after 50% deformation develops yield and ultimate strengths of 250,000 and 300,000 psi, respectively. At 90% deformation, these strengths rise to 310,000 and 350,000 psi.

Similarly, for a 0.41%-carbon steel deformed 90%, the yield and ultimate strengths are 330,000 and 400,000 psi, respectively, after a 1-hr temper at 212 F. These same strength levels, but with far less ductility and toughness, are attainable in conventional heat treatment only by using steels with at least 0.43% carbon.

In the range 200-800 F, the tempering temperature has little effect upon yield strength or percent of tensile elongation. Tempering is necessary only as a stabilizing treatment. •

Vibration analysis uncovers grinding faults

Manufacturing control of quality on a line of grinders is being accomplished by vibration analysis in one automotive plant. This new application for equipment originally applied to check engines in hot-test stands was reported to the SAE National Production Meeting by D L Bernhard, International Research & Development Corp.

Preliminary vibration analysis

First step in the procedure is to establish a good initial condition on each machine. Vibration analysis will reveal the causes of the vibration that occurs in the direction of the cut. Bad belts, unbalanced wheels, drive motor, and pumps are the most usual causes.

A 100% inspection of finished parts for a short period of time, but over several dresses of the wheel, will reveal the size and finish actually being maintained. Vibration is then reduced to the level of 30 to 80 microin., peak-to-peak displacement, by replacing belts, balancing drive pulleys, motors, pumps, or anything else needing it. Balancing the grinding wheel should be the last step.

In the auto plant that used this method on profile and contour grinders, according to Mr Bernhard, a larger number of parts was produced per dress with better control of finish and size than before.

Periodic measurement

Once such conditions are established, periodic vibration measurements will show when belts are deteriorating, wheels need balancing, or other difficulties arise. And it can do this, says Mr Bernhard, before parts are spoiled.

Rework reduced

A bearing manufacturer has established a limit of 40 microin. vibration on grinders where concentricity of 15 microin. and finish of 3 microin. is required. Previously rework ran as high as 50%. The vibration limit is said to have reduced this, though the exact amount was not stated.

The vibration analysis is performed with an analyzer that has a tunable filter, similar to a radio tuner, so that it singles out a single vibration at a time for study. This greatly simplifies the tracing job. •

Table I—Comparative physical properties, cutting and wear rates of electrode materials (as compared with brass electrodes)

Electrode Material	Basic Constituents	Volume Wear Ratio		Metal Removal Rate		Resistance to Edge Breakdown	Density g/cc	Hardness Rockwell	Electrical Conductivity % IACS
		On Steel	On Carbide	On Steel	On Carbide				
Sparkonite*#1	Copper	6.9	1.0	A	A	II	8.0	7.0 R_N	81
Sparkonite #2	Copper	7.5	1.2	A	A	II	8.4	75 R_F	71
Sparkonite #3	Graphite	5.0	0.3	A	A	III	1.7	—	0.2
Elkonite*20-S	Silver tungsten	15.1	5.8	B	B	I	15.6	90 R_B	49
Elkonite 30W3	Copper tungsten	12.9	5.7	C	A	I	15.6	103 R_B	42
Elkonite 10W3	Copper tungsten	10.4	5.2	C	A	I	14.7	98 R_B	46
Elkonite 35-S	Silver tungsten	9.0	4.9	B	B	I	14.8	85 R_B	51
Elkonite G14	Silver tungsten carbide	7.7	3.5	A	B	I	12.9	100 R_B	38
Mallory 1000	Tungsten copper nickel	11.9	2.4	C	B	I	16.9	25 R_C	14
Yellow Brass	Copper zinc	1.9	0.25	A	A	III	8.4	55 R_B	27

*Trademarks of P R Mallory Co

Wear comparison of materials specifically designed for EDM with that of brass. A is equal to or better than brass B is slower than brass, and C indicates low rate on small-capacity machines and better rate on high-capacity machines. On edge-breakdown resistance. I indicates 9 to 10 times as long as brass, II is 4 to 5 times brass, and III is about equal

Pick the *right* EDM electrode

By A R Gaus, staff engineer
Mallory Metallurgical Co
Division of P R Mallory & Co
Indianapolis

Choice of electrode material for electrical discharge machining is fully as important as selection of the right cutting tool for more conventional machining.

The best electrode for a given job can, for example, reduce the cost of making electrodes, cut down on the number of electrodes required, and even speed up the operation itself.

A poor choice, on the other hand, can prevent the process from working at all.

Selection of an EDM electrode must take into account five factors:

- Volume-wear ratio
- Cutting rate
- Shape versatility
- Edge-wear ratio
- Cost

The first three of these factors can only be evaluated if a specific electrode and specific work material are tested under controlled conditions on a specific type of machine.

It is possible, however, to make a general evaluation of electrodes as they operate on various work materials at a specific machine. This will give a fairly good indication of how an electrode will perform in a new application.

Criteria defined

Volume-wear ratio is the amount of work material removed, divided by the amount of electrode consumed —figured by volume. A ratio of 8.0 means that 8 cubic inches of work material were removed while 1 cubic inch of electrode was consumed.

Obviously, the EDM process is attractive if the volume-wear ratio is 8 or 10, or 20; but it is less attractive if the ratio is only 4 or 2 or 0.25. Wear ratios over a range from 20 down to 0.25 have actually been recorded.

Cutting rate is the amount of work material removed per minute—measured either by weight or volume. This figure can vary all over the lot, and only has real meaning if it is known what work material, what electrode, what machine, and what operating conditions are involved. Table I shows cutting rates of various materials compared to that obtained with a brass electrode. Actual numerical values are given in Table II.

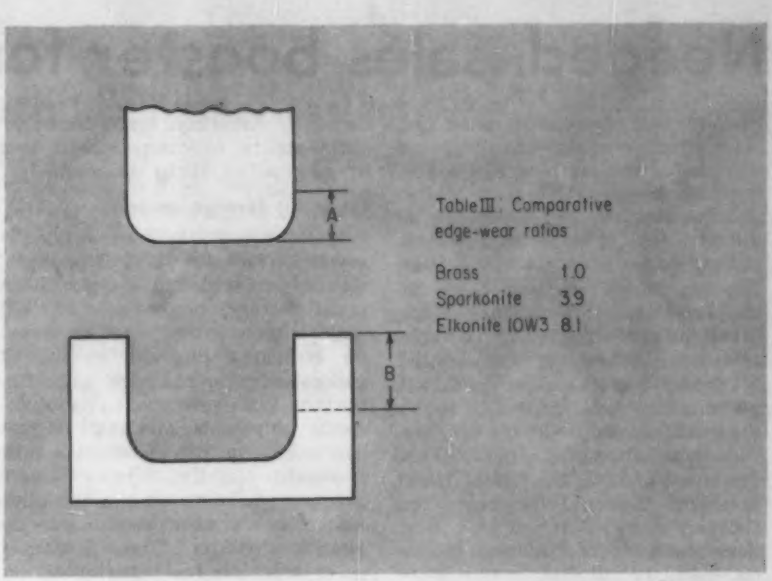
Some electrode materials, as shown in tests on several different machines, are basically unsuited to a particular job. For example, the cutting rate for 30WS on steel (Table II) is so low that it may be considered impractical for a low-powered electrical discharge machine.

While cutting rate is generally considered first in selecting an electrode, **edge-wear ratio** is also important because EDM must often

Table II: Comparative metal removal rates (grams per minute)

Sparkonite #1	0.32
#2	0.40
#3	0.24
Elkonite 20-S	0.15
30W3	0.01
10W3	0.01
35-S	0.02
G-14	0.27
Mallory 1000	0.002
Yellow Brass	0.23

Measured with 15 ampere power supply ⅜-in. diameter electrode with 3/16-in. hole. Machine controls set for maximum cutting rate.



Edge-wear ratio is the length of straight cut into the work (B) divided by the length of side eroded on the electrode (A). *Concept courtesy General Motors Corp Manufacturing Engineering Dept*

Metal-removal rate was checked with a 15-amp power supply, using a ⅜-in. rod with a 3/16-in central hole. Machine was set for maximum cutting rate, and the work was 52100 steel

produce sharply defined corners and edges in the work. The edges of the electrode face are eroded more rapidly than the rest, and this causes some tapering as shown in the diagram. Table III indicates comparative edge-wear ratios for three electrode materials.

Tests on several different machines show that relative cutting rates of electrode materials are consistent. Table II summarizes cutting rates of 10 electrodes, tested on low-powered EDM equipment. In some cases, electrode materials with poor cutting rates at low power will perform efficiently on higher powered machines.

Shape versatility is an important factor in EDM because odd shapes in the workpiece are often the sole reason for going EDM. Many of the most successful current electrode materials are made by powder metallurgy, and this process creates limits in size, shape, and form. Electrodes are also machined from solid stock. Each material therefore has limits that must be considered when choosing an electrode.

Cost of an electrode material is not usually a major factor in EDM, but the cost of *fabricating* an electrode (including all duplicates and roughing and finishing variations) is often an overriding factor. The most expensive electrode materials can be applied as thin facings so as to reduce total cost. For large electrodes, a relatively low-cost material is generally considered desirable.

Materials available

Brass, the original EDM electrode material, still finds wide application because it is readily available, easily machined, and not too expensive. Standard brass stock is often most efficient—such as brass tubing to cut round holes. Brass is the basis for comparison of performance in Table I, where it is contrasted to newer materials specifically designed for EDM.

Also tabulated are three general kinds of electrode material. Sparkonite 1 and Sparkonite 2 are powder-metal products, mainly copper with additives that improve their EDM performance. They are soft, easily worked, and relatively low in cost, are also ductile, and can be coined and hobbed. They approximate the performance of Elkonite on tool steel and similar materials, and display high-metal-removal rates on all work materials.

Maximum bar size at present is about 1 x 2 x 7½ in. For repetitive production jobs, these materials can be pressed and coined into electrode shape in large numbers and to close tolerances.

Sparkonite 3 is basically graphite—a good general-purpose electrode material. Soft and easily chipped, it requires careful handling.

The Elkonite materials cover three types; silver-tungsten (20-S and 35-S), copper-tungsten (10W3 and 30W3), and silver-tungsten carbide (G-14). All have good volume-wear ratios and good resistance to edge-wear. These are also powder-metal products, fabricated to maximum lengths of 8 in. Cost is fairly high, but thin plates can be brazed to a base metal electrode—soft solder and silver solder both work.

Copper Elkonites

The copper Elkonites (10W3 and 30W3) both cut steel and carbide on high-capacity machines, but they may not cut at all on low-powered equipment. All of these materials can be machined to any tool shape, preferably with carbides, and can be ground. However, ductility is low, and they cannot be formed or coined.

Mallory 1000 is similar to the copper Elkonites in EDM characteristics, and is available in slabs up to 2 x 2 x 12 in. It has higher tungsten content, is more versatile, can be swaged into wire as thin as 0.062 in. •

Needed: sales booster for U S tools

Machine tool distributors must find more effective means of selling and servicing if the machine tool industry is to prosper, George E Merryweather told the spring meeting of the American Machine Tool Distributors Association at the Hotel Mark Hopkins, San Francisco, March 23-25. Merryweather is the Association president and president of The Merryweather Machinery Corporation.

Demand for all capital goods will be restricted until customers regain the confidence spurring them to proceed with plans for expansion and for new products, Everett M Hicks, president National Machine Tool Builders Association and vice president Machine Tool Division, Norton Co, said.

Minimum wage "imposition"

Confidence can be restored, he said, when the federal government recognizes the necessity for a balanced budget and when it adopts policies discouraging inflation and helpful to industry in reducing its costs. He cited the proposed imposition on the machine tool industry of a minimum wage under the Walsh-Healey Act as the kind of action that discourages rather than encourages confidence.

Increased government spending is the only alternative to growth by private expansion and modernization of industry. Such spending leads to a guided economy, then a planned economy and eventually full socialism, Hicks pointed out. He noted that while the Russians are moving farther away from their original concepts of Communism, we seem to be moving farther away from our original concepts of liberty.

Tax law revamp urged

Hicks stressed the need for revamping tax laws to allow more rapid depreciation of production equipment and to encourage formation of new capital to be invested in job-creating enterprises. He advocated abolishing laws and policies giving unions monopolistic and coercive powers, and restoring competition to the labor market. "American labor is forcing American business out of export markets, inviting lower-cost imports and in fact pricing itself out of jobs," he contended.

Excessive costs thus are at the basis of the poor performance of the U S machine tool industry the past few years and of the loss of confidence by American businessmen of their ability to compete with our overseas allies, Hicks declared.

Growing foreign inroads

Machine tool sales have never recovered from the 1958 depression. Not only have domestic orders been unsatisfactory, he commented, but imports have grown steadily. Based on estimated physical volume of general-purpose machine tools, imports in 1959 were about 17% of domestic shipments, and there is reason to believe that in 1960, the ratio increased slightly. When Western European builders are less busy than now, they will provide even more serious competition in the U S market.

No machine tool distributor can effectively sell both U S and foreign machines in this country at the same time, he declared. "You cannot tell a customer today all the reasons why he should buy a U S machine and tomorrow offer an import with a low price tag for some other application!"

Trade with Russia?

Refusal to sell U S machines not on the forbidden list to Russia simply donates business to Germany and Britain, Hicks asserted. Russians are trying to increase and modernize their automotive production. Our decision not to sell machines to them for that purpose will not stop them because they can buy what they need elsewhere.

Hicks, who visited Moscow in January, expressed his opinion that more trade between the Soviet bloc and the West would be a good thing.

"If the Russians want to copy, they will have little trouble in obtaining samples of most of our production machines, because many of them have been sold to countries all over the world."

Maintain lead with R&D

Our only real security, he said, "lies in our continued improvement through research and development programs which will help us to maintain the machine tool gap." Such research costs money and must be financed from substantial sales volume. If such sales cannot be found in our domestic market, "we may be shortsighted to refuse to accept business from Iron Curtain countries."

New production techniques and new equipment are needed to make parts and assemblies of missile systems, if reliability requirements are to be met, said three representatives of Lockheed's Missiles and Space Division—S N Bean, C H Rutledge, and George Irving. Bean observed that Lockheed is now working metals at or near their plastic temperatures, thus requiring new methods of applying large amounts of heat to materials and of sensing and controlling these temperatures.

Equipment capable of performing a special type of operation on several different parts is needed, he said, because the quantity of missile production is limited. Rutledge noted that making electronic connections with a high degree of reliability is a serious problem. Use of miniature spot welders, for welding the leads of various components in small assemblies, shows promise.

MAPI formula for Services

Using a simplified version of the MAPI formula, the Armed Services have embarked on a modest machine tool modernization program that is paying its own way, R W Righter, the Navy's top machine tool specialist said. The procedure by which replacement is measured is equally applicable to the sophisticated numerically-controlled machine costing $100,000 or more and to the manually-operated, moderately priced bandsawing machine.

The military departments took their cue from progressive industries," Righter stated. Experience to date demonstrates that increased budget allocations for the modernization program are clearly justified. The program calls for expenditure of $26 million in fiscal 1961: Army $6 million, Navy and Air Force $10 million each. And of $24.1 million in fiscal 1962: Air Force $14 million, Navy $5.1 million, and Army $5 million.

$2.8 billion Service inventory

The three Services, according to Righter, have 231,000 machine tools valued at $2.8 billion. The Navy possesses 89,000, the Army 82,000, and the Air Force 60,000. Of the overall total, 41% dates from 1949 or prior years, 50.5% from 1950-54, and 8.5% from 1955 or more recent years.

For comparison, he cited the AM/MM inventories of metalworking equipment, which show that the average age of machines has been worsening since 1945—with three out of five machine tools at least 10 years old in 1958. •

Russian engineers report

Arc machining of tough alloy-steel castings

The inherent toughness of some stainless steels and high-temperature alloy steels makes conventional machining difficult, especially when the workpiece surface is marred by casting scale or slag inclusions, or both. To overcome this difficulty in machining cylindrical castings of such tough materials, two Russian engineers have come up with an electric-arc machining arrangement that is reported to be quite effective for removing metal. No mention is made, however, of operating costs.

As described in a recent issue of Stanki i Instrument (a Soviet technical journal), the test rig developed by M E Juchwid and A T Krawitz resembles a lathe, in that the workpiece is held by a chuck and tailstock and the cutting tool is mounted on a toolslide capable of longitudinal and transverse motion. The cutting tool in this setup is the electrode, and it takes the shape of a rotating, water-cooled, steel disk.

The workpiece can be rotated at speeds of 1.25 to 16.5 sfpm; the steel disk (electrode), at speeds of 115 to 140 sfpm. The disk is moved toward the workpiece until the faces just touch. The arc formed between the two metal faces melts away metal from the workpiece. (Voltage tapped from a 95-kva welding transformer is supplied to slip-ring and brush assemblies located on the workpiece spindle drive and on the disk drive spindle.)

Smooth finish

The outer edge of the rotating electrode can be flat or tapered, but the Russians found that by chamfering the edge so that actual contact between disk and workpiece is reduced, they obtained a reasonably clean and smooth finish wthout any sign of sputter. Best finish was obtained by rotating the disk and the workpiece in opposite directions.

Cooling water, flowing through a duct built into the outer edge of the cutting disk, keeps the temperature of the disk between 175 and 195 F. Periodically, a jet of cold air blows along the length of the workpiece to remove excessive heat generated during the cutting process.

The Russian engineers varied cutting depth between 0.039 and 0.52 in. and longitudinal feeds between 0.117 and 0.78 ipr. Within these limits, the specific energy consumption of the arc varied between one and two kilowatt-hours per kilogram (2.205 lb) of metal removed. As feed rate was reduced, specific energy consumption rose rapidly, and at 0.39 ipr was double normal consumption.

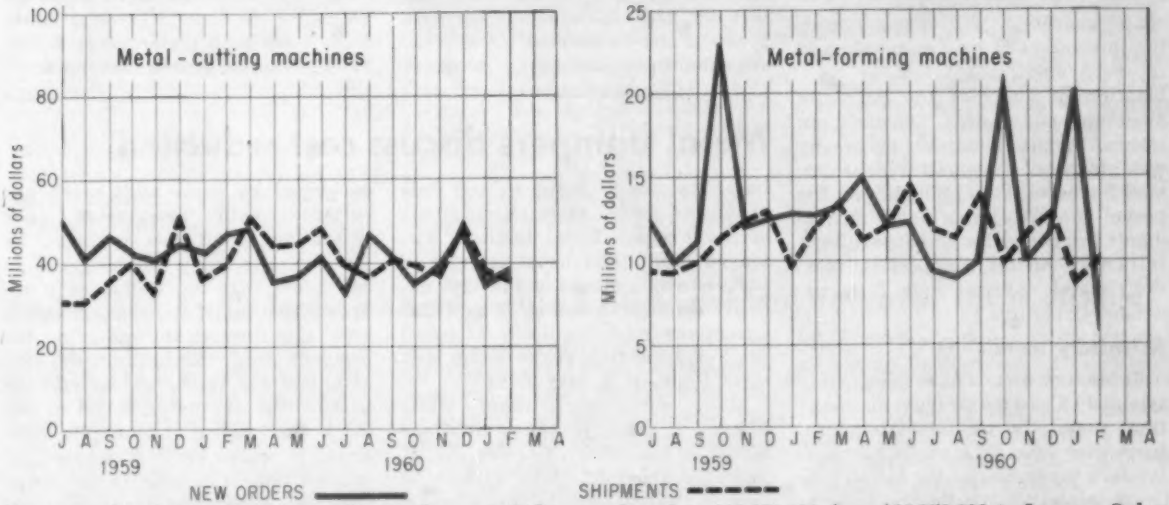
Optimum workpiece surface speed proved to be between 10 and 13 sfpm. Other experiments indicated that specific energy consumption was 20 to 30% lower when machining high-alloy steels with low thermal conductivity than when machining plain carbon steels.

Thermal conductivity

Further examination of the workpiece showed that the surface layer exhibiting the fine dendritic structure characteristic of melted and cooled metal became shallower as the thermal conductivity of the material decreased. On carbon steel, for example, this layer was 0.624 in. thick, whereas on high-alloy, heat-resistant steels, the layer was usually about 0.011 in. thick and only rarely exceeded 0.019 in.

In every test run by the Russians, the arc-machining raised the surface hardness of the material, and in no case did the finished surface vary more than 0.023 in. from the theoretical cylindrical surface. •

NMTBA Index of machine tool new orders and shipments



Net new orders for metal-cutting machine tools rose in February to a total of $39,300,000, according to preliminary figures from the National Machine Tool Builders' Association. Orders in January were $35,750,000. Shipments in February slipped to $36,050,000 from $36,950,000 in January. Orders for metalforming machine tools totalled $6,700,000 in February, down sharply from January's $20,350,000. Shipments rose to $9,900,000, up from $8,550,000 last month

Western Metal Show highlights

Space-age metals and techniques

- **What are the latest developments in refractory alloys?**
- **Where does high-energy-rate forming stand today? Where is it going?**
- **What is the potential of electron-beam welding?**

These questions—and their answers—brought more than 40,000 engineers, metallurgists, and manufacturing executives to the 12th Western Metal Exposition and Congress in Los Angeles, March 20-24. They heard more than 100 technical papers and saw exhibits from about 300 companies in such fields as cleaning and finishing, research and testing, welding and joining, metals and alloy production, control, inspection, industrial and mechanical equipment, parts and components, small tools, even machine tools.

New, better, lighter metals

Major General O J Ritland, commander, Air Force Ballistic Missile Division, Air Research and Development Command, said, "Materials are more than ever the key to progress in aerospace." He gave as examples the successful solution to re-entry problems and the development of suitable materials for rocket propulsion systems.

In the same vein, Leo E Gatzek, head of materials engineering, Aerospace Corp, said that future aerospace operation will demand both the innovation of new materials and the refinement, adaptation, or combination of many of the currently available materials. "Development trends," he said, "indicate that many new classes of materials will be created for aerospace application in the period to 1970. Important improvements are slated for the superalloys, refractory metals, composites, plastics, metal fabrics, and filament-wound structures."

Refractory metals

Refractory metals have been firmly established as a major hope for structural materials for use at temperatures over 2000 F, according to E D Weisert, supervisor of the Metallurgy Group, Materials and Process Laboratories Test Division, Marquardt. He pointed out that refractory metal and alloy technology is new and that investigations to date have only begun to scratch the surface of possibilities.

Trend to special forging alloys

During the past ten years there has been a steady trend toward use of specialty metals and alloys in the forging industry, reported John Luchok, Vacuum Metallurgy Dept, Wyman-Gordon Co. "Most of these metals," he said, "require melting by one of the various vacuum processes. As a result, a variety of new alloys has been developed along with a general upgrading of existing materials, especially steels."

Along similar lines, Dr I S Servi, director, Research Metals Division, Kelsey-Hayes Co, pointed out that vacuum induction melting has been commercially applied to production of low- and high-alloy steels, nickel-iron chromium-base alloys for moderate temperature service, nickel and cobalt-base alloys for high temperature service, and other special materials.

"Chromium, beryllium, silicon, uranium, and alloys based upon copper, silver, gold, tin, and germanium have also been melted successfully by this process," said Dr Servi. He predicted that while vacuum induction melting has not yet reached maturity, it is likely to continue its present growth pattern mainly through the introduction of new products and by teaming up with the consumable-arc remelting process.

Electron-beam welding

In describing electron-beam welding, Ernest G Thompson, Marquardt Corp, outlined a program that evaluated joining arc-cast molybdenum (0.5% titanium) sheet for structural applications, using both low- and high-voltage welding equipment.

The process permits modification and control of the chemical composition of weld metal during welding, often resulting in substantial gains in quality. "Techniques of adding alloying elements are particularly advanced in welding low-alloy steels, stainless and heat-resistant steels," he said, "but the process can be used to some extent in joining practically all metals."

High-energy-rate forming

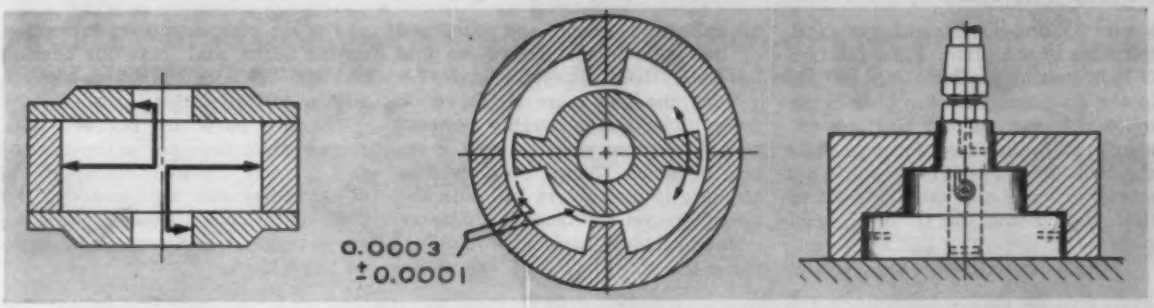
Explosively formed stainless-steel and titanium missile tanks, 4130-steel and Rene 41 turbine-manifold parts, aluminum and stainless steel missile domes and enclosures, and 15-7 stainless structural panels were exhibited by Rocketdyne Division of North American Aviation.

Other examples of high-energy-rate forming applications included the missile flanges produced on Dynapak and Hermes high-energy-rate-forming machines at Arcturus Mfg Co. This display also included beryllium compacts, impellers made of Vasco-Jet 1000, and several parts made from such materials as A-286, 17-7PH stainless, and aluminum. •

Metal stampers discuss cost reduction

Beset by slack business and low profit per dollar of sales, members of the Pressed Metal Institute displayed more than usual interest in cost-reduction means at the 12th annual technical meeting. About 250 executives and engineers attended the 3-day meeting at the Hotel Belmont Plaza, N Y, Mar 22-24.

Many notes were taken while Stanley R Cope, president of Acme School of Die Design Engineering, illustrated about 50 kinks on how to save material, how to make metal move as desired. He gave many examples of how stock is wasted (up to 22%) in the scrap strip layouts developed by firms with much experience with progressive dies. Wrinkling is often a problem, he said, because many die designers do not know that the radius of a redrawn shell must strike on or below a 45° line through the radius on the previous shell. "Smiles" on the side of a box are produced, he claimed because the die design failed to call out a small radius and suitable draw bead. In many other examples, he showed how it is possible to design tools for easier and faster removal of piece parts. And he discussed the advantages of designing into the die means for air ejection for parts. •



End-result gaging establishes end-plate- and cylinder bore concentricity by setup

Missile actuator rotor requires uniform clearance through 150° arc of travel

Fixed air plug and stepped master ring assembly used in setting up fixture

"End result" air gaging

Taking the guesswork out of assembly

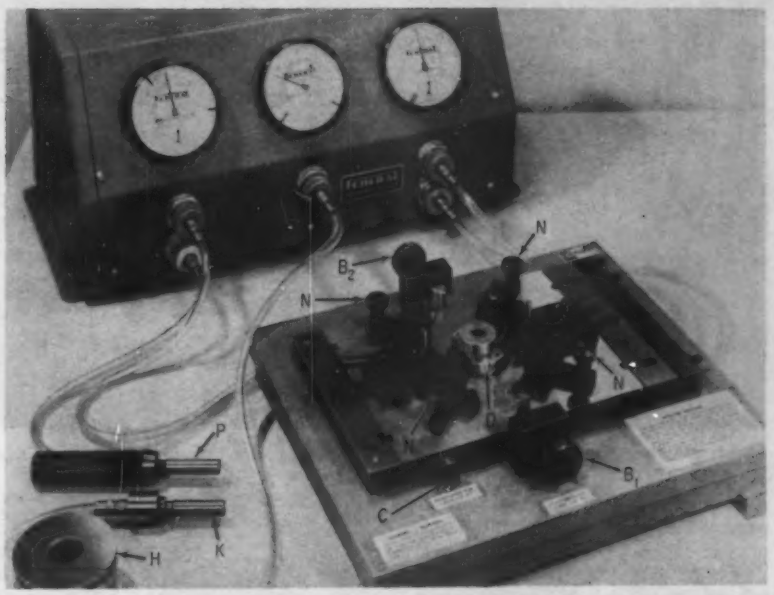
By Rupert Le Grand,
senior associate editor

Tedious trial-and-error methods can be avoided in assembly, even if concentricity or alignment of several parts must be held to tenths. Federal Products Corp, Providence, has proved this with its "end result" air gaging concept, which has solved a broad range of assembly problems simply by establishing correct geometrical relationships between the parts at each stage of assembly.

It is, of course, common practice to inspect individual parts before assembling them, but end result air gaging carries this a step further by inspecting the components in relation to each other.

It all boils down to this: end result-gaged parts fit one another when they are assembled, no matter how close the tolerances. Space Age metalworking leaves no room for "cut and try" methods.

How does end result gaging work? Let's take a look at four tricky precision assembly problems solved by Federal Products:



Setup for gaging components of a missile flight control actuator. Special fixture (foreground) positions end plates with relation to cylinder—so that rotor has uniform clearance. Key: B_1 and B_2—fixture plate shift adjustment in relation to air plug, *C*—lateral movement of part in relation to plug, *D*—stepped air gage plug which represents outer dials (1) on gaging unit, *H*—master ring for air plug *D*, *K*—portable air gage to sweep end plate bore (readings are shown on center dial), *P*—plug gage for rough location of end plate, *N*—Fine adjusting screws for zeroing position of end plate as portable air gage sweeps the bore

PROBLEM 1: To make and assemble a flight control actuator for a missile

Here, a clearance of 0.0003 in. ± 0.0001 in. has to be maintained between the vaned rotor and the cylinder walls—while the outer rotor moves through an arc of 150°.

The rotor is held by two end plates doweled to the cylinder. Conventionally, such components would be machined and then checked for OD's, ID's and dowel-pin location with individual gages. Then, by selective assembly, a shop might hope for a product within tolerance and which possesses satisfactory operating characteristics.

No such hit-or-miss assembly with end result gaging. An air gage setup checks and assembles the two end plates to the cylinder in correct relationship to the rotor. This is how it is done:

The triple-unit air gage and the fixture combine to serve as a high-magnification positioning indicator. A setup is made to a stepped master ring and single-jet air plug.

The master is centered in two

planes by fine-adjustment screws at the sides of the plate. Final position is indicated by zero readings on one of the air gage dials, the plug being indexed to each of four positions 90° apart. The other two air gage dials are then zeroed to the master's diameters, which represent the ID of the cylinder and the ID of the end plate.

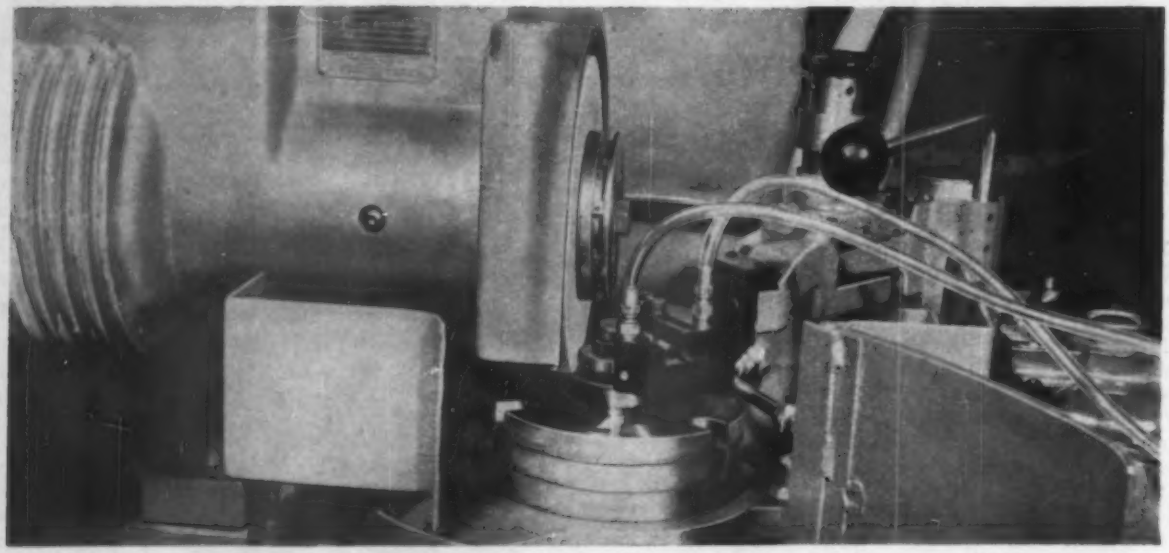
The master is then removed and the cylinder is loaded and positioned by fine adjustment screws—so that the outer dials return to zero.

Next, the end plate is placed on the cylinder and is roughly centered by a fixed-taper plug inserted in the bearing hole. Then a portable dual air plug is inserted in the hole and swept around the bearing diameter.

Radial fine-adjustment screws position the end plate until the sweep of the air plug causes no indication on the center dial. Now the bearing and the cylinder ID are concentric within ±0.0001 in. or less.

The two parts are fastened with screws while they are in the inspection fixture, are then taken out so dowel holes can be reamed. The final operation consists of pinning the parts together and rechecking them in the fixture.

PROBLEM 2: Ball bearing assembly requires a predetermined amount of preload. Errors in setup and grinding must be circumvented by match grinding



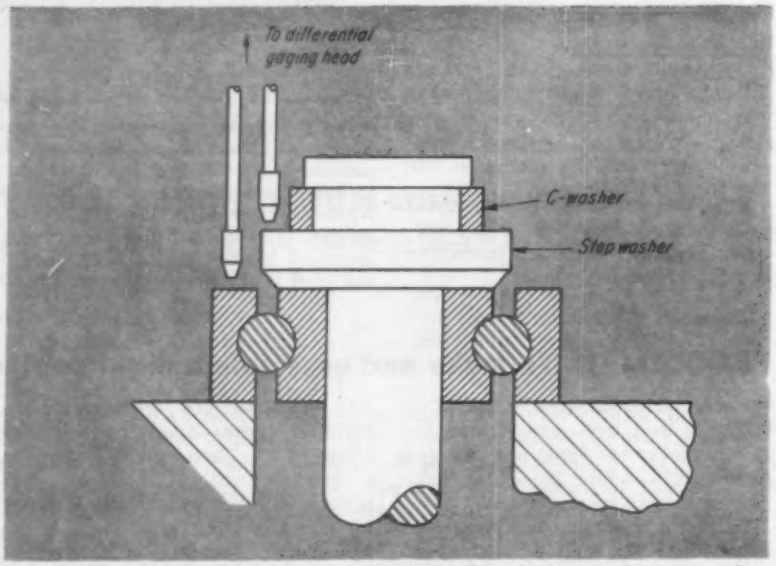
Match grinding of an assembled bearing establishes preload accurately, reduces assembly cost

Originally, the bearing was assembled on an arbor, and the faces of the inner and outer rings were gaged to establish the difference in height. Then the face of the outer bearing race was ground separately.

Now with match grinding, the bearing is assembled on an arbor with a washer of known thickness, and preloaded. The air gage has two heads, one for gaging the face of the washer, and the other the outer ring. Grinding is done until the signal from one gage equals that from the other gage head.

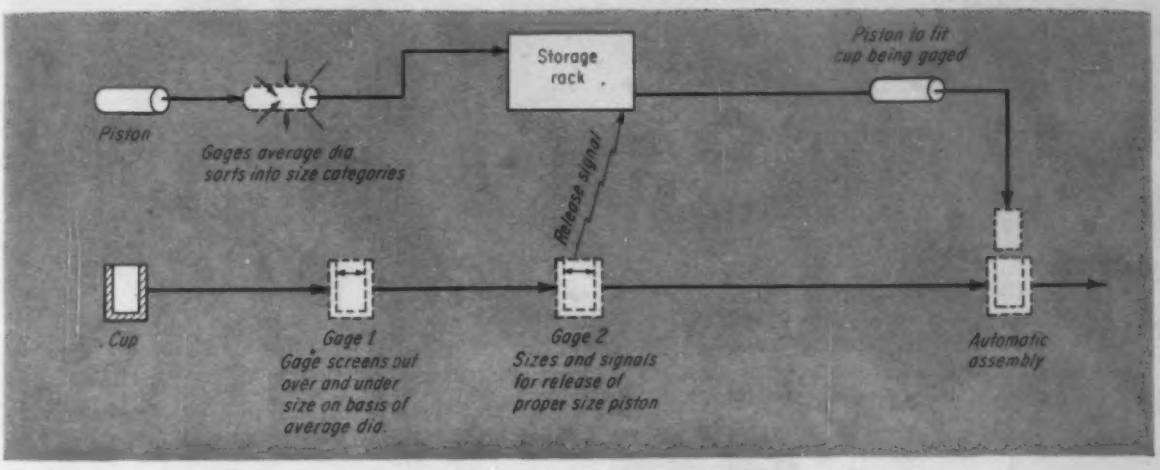
Obviously, the differential gage takes into account the step height from the washer face to the surface of the inner ring.

Here, match grinding eliminates human error, and at the same time consolidates measurement and grinding, thereby reducing costs—an achievement especially important because the tolerance is to tenths.



Differential air gage eliminates need for dismantling bearing and then grinding outer ringer separately

PROBLEM 3: Assembly of a hydraulic valve lifter, with the proper fit or annular volume, to create a hydraulic cushioning action by controlled leakdown rate


Storage rack
Piston to fit cup being gaged
Piston
Gages average dia. sorts into size categories
Release signal
Cup
Gage 1
Gage screens out over and under size on basis of average dia.
Gage 2
Sizes and signals for release of proper size piston
Automatic assembly

Schematic arrangement of gaging and assembly equipment for hydraulic valve lifters

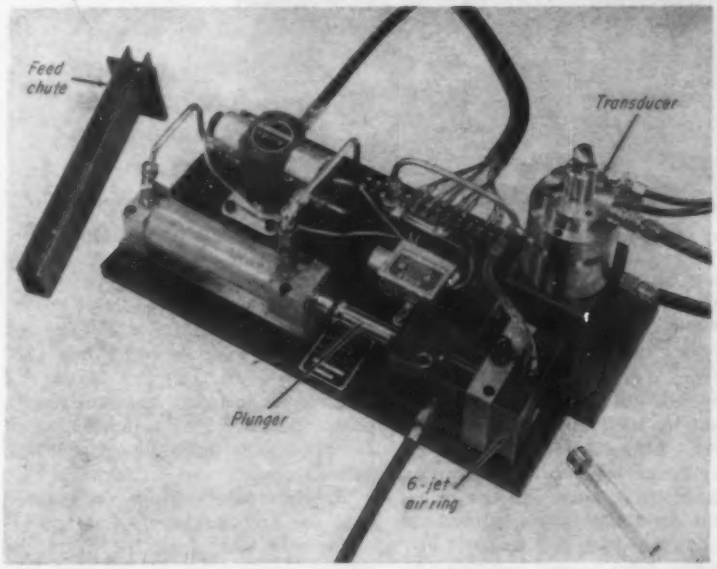
This product consists of a piston, cup, check valve and spring. In normal gaging practice, girls checked the ID of the cup with a 6-jet air gage (which averaged readings at three locations) and segregated them into 20 size categories of 0.0002 in.

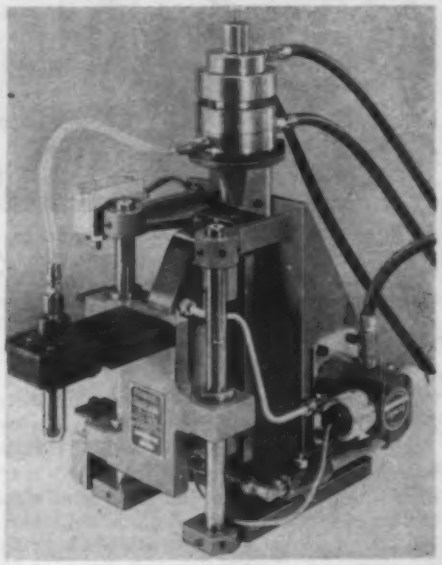
Simultaneously, the piston was gaged in a 6-jet air ring and also segregated into 20 size categories. Later, the four parts were hand assembled, but scrap rate was 15%.

To eliminate this human error and to speed assembly, gaging and sorting has since been mechanized with electronically controlled air gages.

The first of these gages has a 6-jet air ring to select pistons for over, under, or within the 0.0004-in. tolerance spread. This gage sends signals to a console, which segregates incoming pistons into the proper 0.0002-in. size category and stores them. Over- and under-size parts are eliminated immediately, and segregation of pieces is automatic.

Cups are first sorted by a 6-jet air plug gage to eliminate over- and under-size parts (because the parts are later put together on an assembling machine). The remaining cups are then sorted for good size—if the gage decides that a part in category 3 is at hand, a signal is sent to the console, which delivers a category 3 piston.

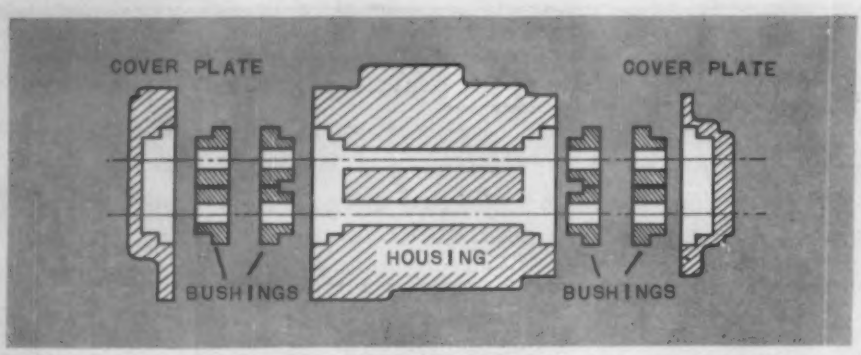




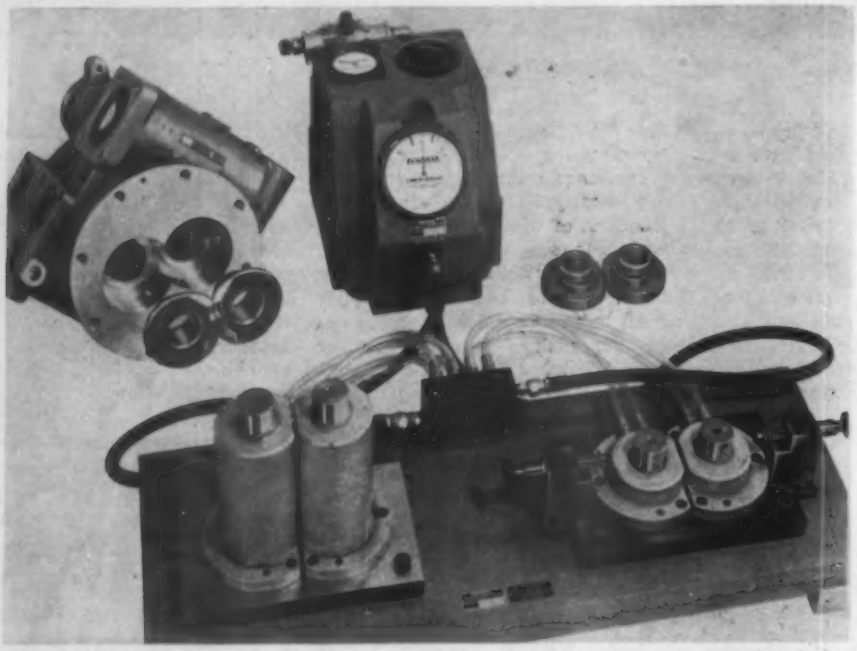
(Left) piston-sorting gage receives parts from feed chute, eliminates over-or undersize parts, sends acceptable pistons to storage rack, then signals the rack to segregate pistons by size categories. (Right) Cups from valve lifters are transported by indexing chain to a nest under this gaging head, and an air cylinder causes the air plug to enter the cup. Air pressure is fed back to a transducer, which converts pressure to voltage in an electronic head. Signal is amplified and transmitted to the storage rack, where a piston of correct size is released to join the cup at the assembly machine

Taking the guesswork out of assembly . . .

PROBLEM 4: To compare center distances of mating parts (to predetermine suitability for later assembly) and to insure that alignment and clearance are within the designer's intent



Eight bushings are assembled within ±0.0005 in. to insure proper bearing alignment in a jet engine fuel pump. Two air gages match center distances



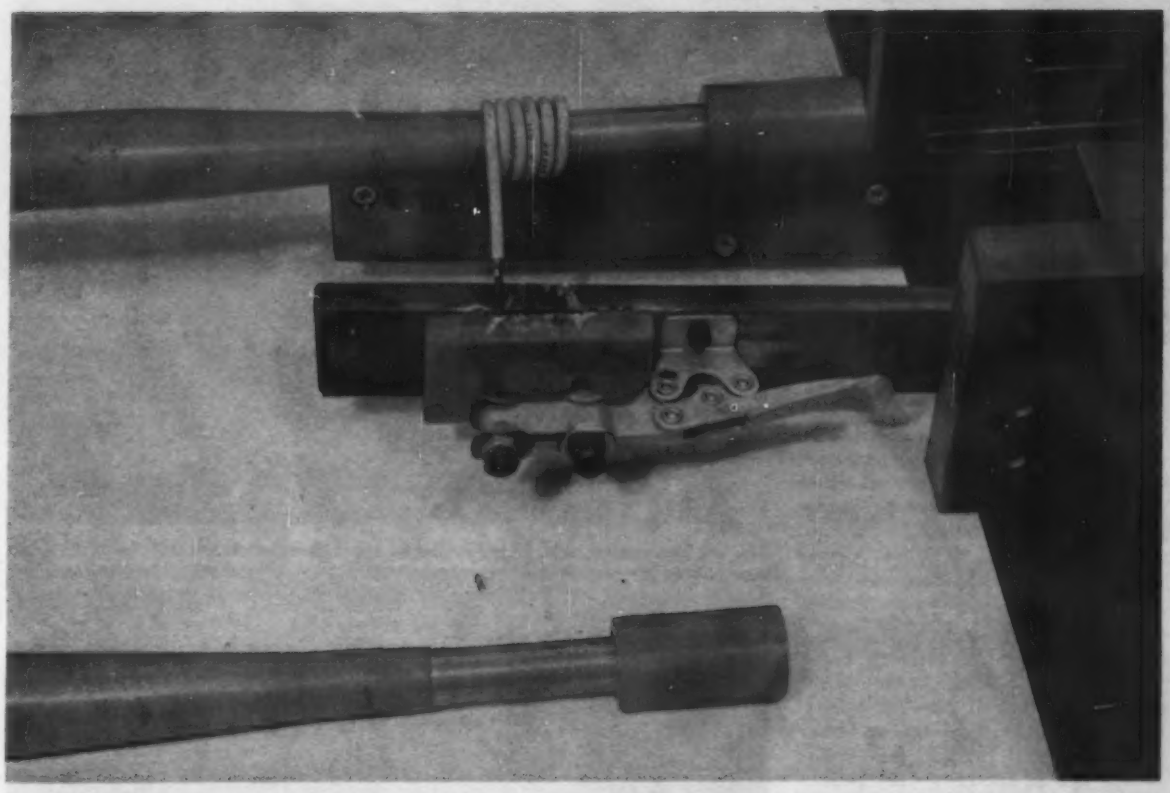
With housing bores located on the gaging plugs of a fixture similar to the one shown, and the bushings in the air rings, gage shows if flange flats will have proper clearance when bushings are assembled in the bores. When bushings (shown outside the bores) are assembled into the housing, they are placed on the large plugs of this gage. Then bushings for the cover plate are placed on smaller plugs in the right-hand fixture. Gage shows if center distances in two pairs of bushings are the same within ± 0.0005 in.

The product here is a jet-engine fuel pump housing with twin bores. Each of the gear shafts is held in four insert bushings (two in opposite ends of a housing bore, and two each in two endplates). When the product is assembled, each gear shaft must run in four accurately aligned bearings. Center distances and parallelism of the two shafts must be held to close limits—±0.0005 in.

Two gaging setups match center distances, and computations are avoided by differential gaging procedures. Inspection time per assembly is now only 5 to 10 minutes, compared to 2 hours, and the rejection rate at the test bench has been reduced from 90% to 5 to 10%.

In the first setup, the housing bores are seated on two gaging plugs to check the center distance of the bores. Various insert bushings are then placed in a second stage of the fixture—until a pair is found with a center distance that matches that of the bores within the ±0.0005-in. tolerance.

The selected bushings are pressed into the housing bores, and the assembly is located on plugs in the second gaging fixture. Bushings for the cover plate are placed on smaller plugs, until a pair is found with a center distance that matches that of the inserted bushings. •



1. . . . Electromagnetic swaging setup uses expendable coil. Electrical energy supplied to coil from capacitor bank generates a magnetic force that swages tapered tube onto cylinder. Inexpensive coil can be used only once because it expands and destroys itself just after swaging operation is complete. Safety guards have been removed here to show setup detail

What magnetic forming can DO

Swaging, blanking, forming and drawing of metal by magnetic force is perhaps the most spectacular metalworking development to come along in recent years. Here is a report on the pioneering R & D that has brought magnetic forming out of the laboratory and into the production stage at Convair*

By A P Langlois, supervisor,
Applied Manufacturing Research
Convair Division,
General Dynamics Corp, San Diego

The direct application of electromagnetism to metalforming is probably the hottest subject of discussion in metalworking circles today Yet electromagnetism is not new; it has served industry for many years. Motors, generators, transformers—all depend upon electromagnetism. Even the television set in your living room depends upon it.

Attention was first called to the metalforming potential of magnetic forces at the Atoms for Peace Conference in Geneva in 1958, when the General Atomics Division of General Dynamics demonstrated how magnetic "pinch effects" could be used to deform thin metal tubes.

In 1958 Convair-San Diego was assigned the task of developing production applications for the use of magnetic forces. Today, at Convair, electromagnetic swaging is a production operation. We can swage fittings to tubing, internally or externally, with our present electromagnetic equipment, and other applications are under development.

What is electromagnetics?

Most of us will recall, from our early lessons in physics, that when current flows in a conductor a magnetic field is established. This phenomenon is known as electromagnetics. In magnetic forming, though, the reciprocal relation—that a magnetic flux field can produce an electromotive force in a conductor—is equally important.

Whenever a magnetic field exists and a conductor is brought into or

* For a more detailed analysis of the physics and mathematics of electromagnetism see "Magnetic forming," by University of California physicists D H Birdsall, F C Ford, H P Furth and R E Riley (AM/MM Mar 20 '61, pp117-121).

through that field of flux, an electromotive force, or emf, is induced in the conductor.

This induced emf is proportional to the rate at which the conductor cuts across the lines of flux, and maximum emf is developed when the conductor moves at right angles to the magnetic field.

EMF and flux linkages

Stated another way, the induced emf is directly proportional to the rate of change of flux-linkages. This means that whenever a magnetic field is varied about a conductor, an emf is induced in that conductor. The direction of this induced emf will be such that it will oppose the change in flux-linkages that produced it. This relationship is expressed in the equation:

$$e = -n \frac{d\phi}{dt}$$

where e is the instantaneous value of the electromotive force in volts, when n is the number of coil turns, ϕ is the equivalent flux in webers, and t is the time in seconds. A weber is equal to 10^8 lines of flux. (One weber per sq meter = 10^4 gauss.) The negative sign signifies taht the emf tends to oppose that change in flux that produced it.

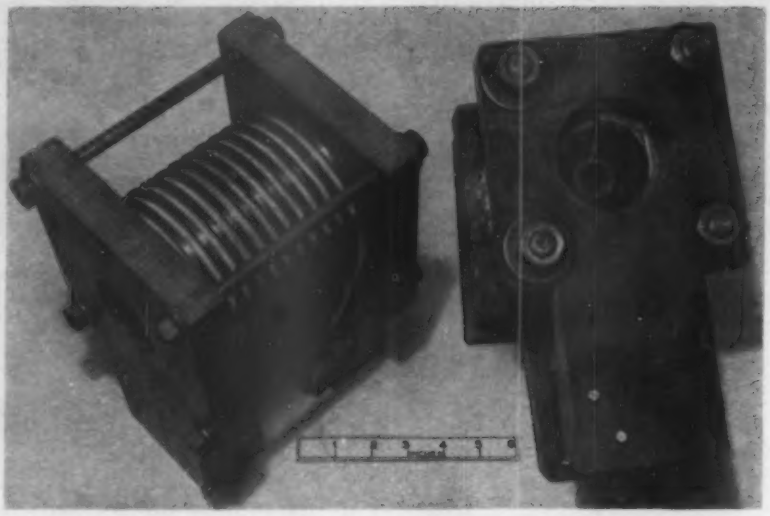
The induced emf in an electrical circuit gives rise to a flow of current that establishes a flux and a magnetizing force that acts on the conductor. (It is this magnetizing force that we harness to form the workpiece.) The magnetic field is in opposition to the initial field that induced the emf. As a result, instantaneous forces are established that are in opposition.

Application to swaging

Having discussed how current produces a magnetic field, and how a magnetic field can produce an emf in a conductor, let us now look at how all this applies to electromagnetic swaging.

When conductive metal parts are introduced in a coil in such a way that they are flux-linked with the coil, the parts can be considered as short-circuited secondary single-turn coils. This means that the primary coil current will be a maximum because of the short-circuited secondary.

Consequently, when electrical energy is applied to the coil, a net resultant magnetizing force is applied to the workpiece. When this energy exceeds the elastic limit of the workpiece, permanent deformation takes place.



2. . . . Permanent coils with beryllium-copper flux concentrators can operate at high energy levels. Standard permanent coils consist of a machined helix insulated with epoxy and fiberglass. End plates counteract stress on coil during forming

3. . . . Expendable coils are wound over mandrels to suit workpiece OD. These, developed for swaging aircraft parts, cost 2-3¢ each, compared to several hundred dollars for permanent coils. Expendable coils are destroyed in use

Re-examination of the basic equation for magnetic induction,

$$e = -n \frac{d\phi}{dt}$$

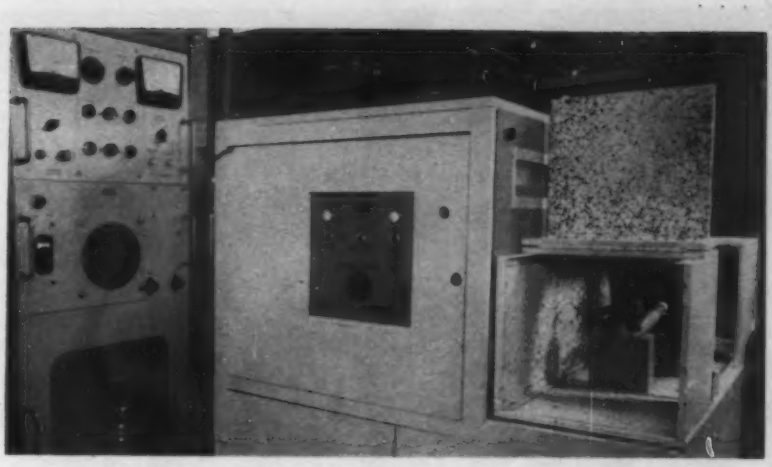
shows that the resultant emf is inversely proportional to Δt, the time period considered. For long time periods the emf will be quite small; but when Δt is extremely small the emf will be very high. For magnetic forming we want to achieve the latter condition. And this is most satisfactorily accomplished through the transient (extremely short-time) electrical discharge of energy stored in capacitors.

Convair's early electromagnetic projects concentrated on what could be done and how it could be applied; little effort was expended on equipment refinement.

Our early work coils were made of solid copper, and the first application was the swaging of fittings into the ends of tubes. Other early work investigated blanking, shearing, forming, and embossing, using flat spiral (pancake-shaped) coils.

Dielectric circuits

A dielectric circuit is ideally suited for metalforming applications; it supplies the storage capacity for electrical energy, and the transient discharge of this energy supplies the



4. . . . Production swaging unit using expendable coil has protective cover surrounding working area. Cover protects operator from flying debris when expendable coil disintegrates immediately after the swaging operation

5. . . . Typical swaged parts include aircraft control rods and torque tubes (left) and an escape rope (center-right). Strength of swaged metal sleeve exceeds that of the cotton rope. Note detail of twisted rope on the metal sleeve

magnetizing field in and around the work coil.

Components of the circuit and their functions are straightforward. A power supply is connected (through a switch) to a capacitor bank consisting of several individual capacitors connected in parallel to the output. (The switch is closed only during the capacitor-charging cycle.) A high-voltage switching circuit is used to discharge the stored energy. Ignitron tubes in series with each capacitor switch the charge into the work coil.

Energy stored in the capacitor bank varies directly with the value of the capacitance (in farads) and as the square of the applied voltage. This is expressed in watt-seconds or joules as: $W = \frac{1}{2} CV^2$

Energy discharge pulses

The discharge of the electrical energy stored in the capacitor bank can follow any one of three possible wave shapes, depending upon the discharge circuit parameters (the resistance R, the inductance L, and the capacitance C).

When $R^2 > 4L/C$ the energy discharge is non-oscillatory; the current rises to an early peak, then declines with time toward zero. When $R^2 = 4L/C$ we get a somewhat similar discharge; the current rises to an early peak (though considerably higher than in the first case) then dies off quite rapidly with time to zero.

The third possible discharge pulse, and the one most commonly encountered, is oscillatory. Here $R^2 < 4L/C$ and the discharge varies sinusoidally with time, but the oscillations are damped and gradua'ly die out. This discharge pulse is satisfactory for metalforming, except in cases where metal thickness or configuration requires all available power. In such cases it is possible to suppress the output so that only the first peak is employed for forming.

Work coil design

Once the capital equipment (power supply, capacitors, auxiliary circuits, etc) has been acquired, the greatest problem is to provide adequate work coils. As we mentioned before, the energy available in the capacitor bank is equal to $\frac{1}{2} CV^2$. Suppose we want to increase the energy level. We can increase the capacitance, but this means additional capital equipment. Or we can increase the charge voltage; this is especially attractive because the energy varies as the square of the voltage.

Unfortunately, increasing the voltage has serious drawbacks. Foremost among them is the harmful effect on the work coils. All work coils include dielectric insulating materials, and these materials break down at voltages above 10 KV.

By forced cooling and prestressing of the coil assembly, we have upped this voltage limit, but we don't look upon these techniques as a solution to the problem. To date we have been more interested in coil configuration and flux field control than in determining the upper voltage limit.

Permanent coils

Coil design at Convair has taken two paths; we now use both permanent coils and expendable coils. We have attempted to develop a permanent coil that is a completely machined helix. The helix turns are insulated with epoxy and fiberglass and baked dry.

The entire coil assembly is then prestressed (under compression) by heavy aluminum-alloy end plates drawn together with steel bolts. This prestressing counteracts the reaction forces acting on the coil during discharge. (The coil, as well as the workpiece, is subject to intense stress.)

The permanent coils shown in Fig. 2 are equipped with flux concentrators made of beryllium copper.

The flux concentrator (developed by Dr Kolm and his associates at MIT) is essentially an air-core transformer with a multi-turn primary and a single-turn secondary.

The induced flux in the secondary tends to shift the primary flux into the inner hole area, thus relieving the magnetizing forces on the multi-turn primary. Such coils can operate at high energy levels with no external support for the primary windings.

Expendable coils

Because a permanent coil can cost several hundred dollars, we have put considerable effort into developing expendable coils. Fig. 1 (p 99) shows a typical swaging setup using an expendable coil. Just after the swaging action is completed, the expendable coil expands and destroys itself, so it is necessary to provide suitable guards against flying debris. (The safety guard has been removed for this photo.)

Fig. 3 shows expendable coils being wound. The coil is made of a few turns of plastic insulated copper wire. Mandrels are made the same size as the workpiece OD. Such coils cost only two or three cents apiece.

Typical swaged parts

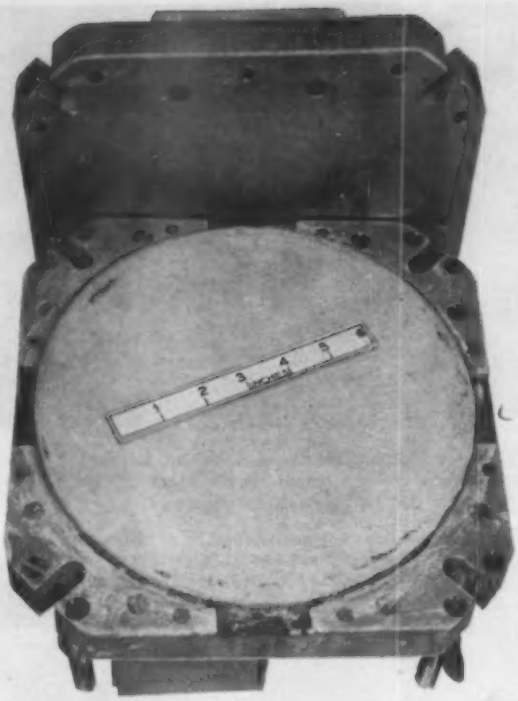
Process variables such as voltage range, type of coil, number of turns, and pre-processing treatment data have been established for swaging end fittings in control rods and torque tubes similar to those at the left in Fig. 5. At center-right in the same photo is a cotton escape rope which called for a metal end sleeve. Successfully attached on the second try, the connector is stronger than the rope.

Present investigations

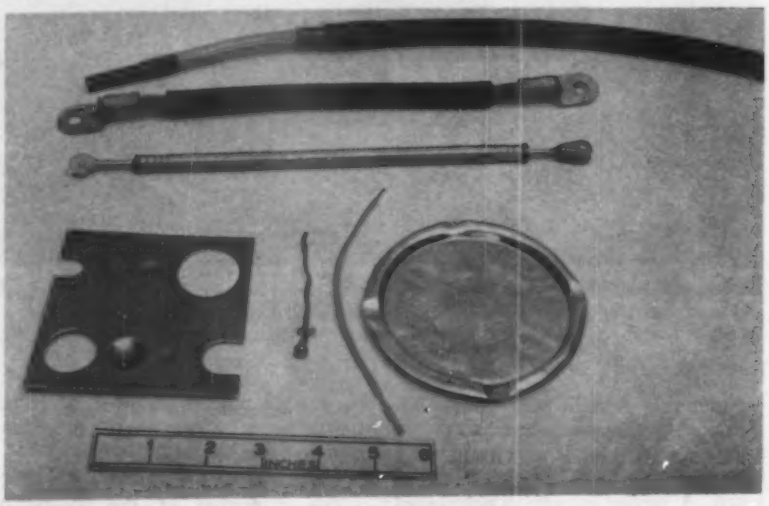
So far we have been discussing swaging primarily, but efforts in blanking, forming, embossing, and drawing of metals have been equally interesting. The approach is basically the same; the power sources are identical, but the work coil is a flat spiral. Fig. 6 shows a flat coil made of copper strip wound into a spiral then potted in epoxy.

Electrical connections are on the under side of the pancake coil. Work is placed between the coil and the removable top cover plate along with a female die half.

Aluminum parts formed and blanked with flat coils are shown in Fig. 7 along with some typical swaged parts. To date, results of flat-coil forming have been fairly well established only for aluminum and aluminum alloys.



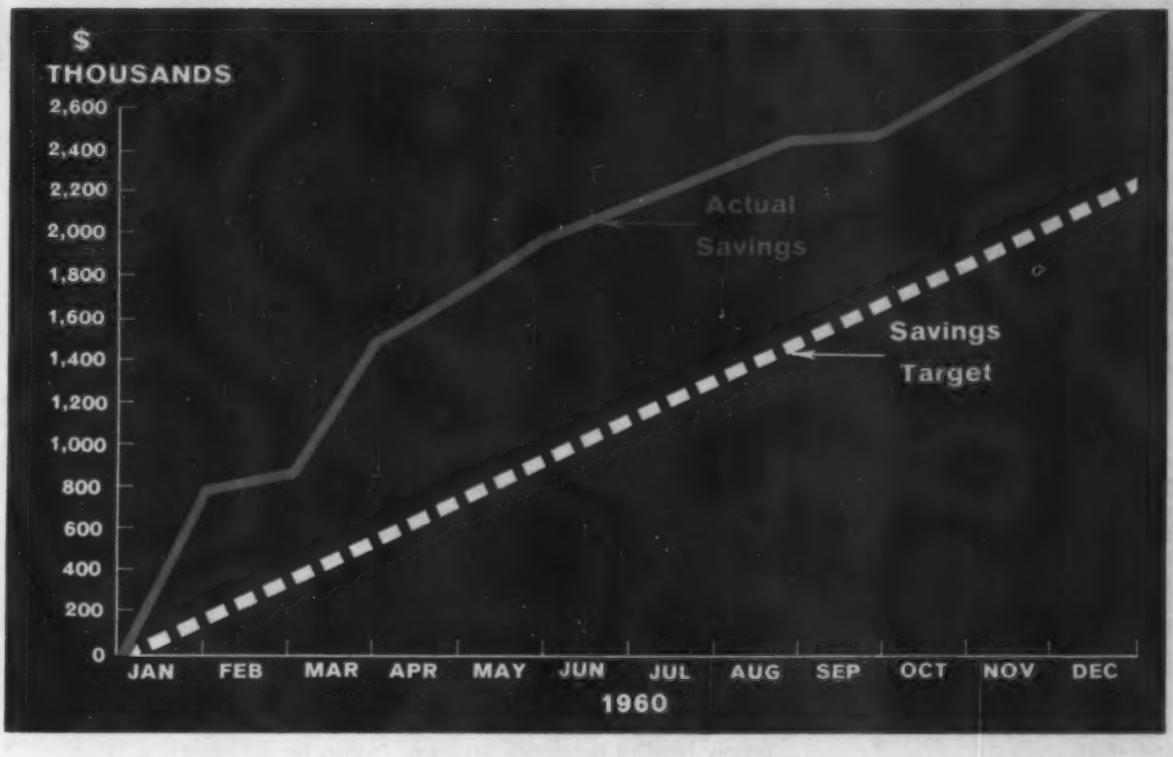
6. . . . Flat pancake coil is used for blanking, forming, embossing, and drawing aluminum. Coil is made of copper strip wound into a spiral and potted in epoxy



7. . . . Formed and blanked parts were produced by a flat coil like that in Fig. 6. So far, flat-coil forming results have been fairly well established only for aluminum and aluminum alloys. Other parts show additional swaging applications

Experiments in electromagnetic forming have certainly been successful. The process is controllable and should lend itself to automation. But permanent work coils require more investigation before they can come into general use and may even be passed over unless they can show advantages over expendable coils.

At present, electromagnetic forming is limited to small parts. Maximum blank size for forming a conductive material is about 12 in. diameter and up to 0.125 in. thick, but in the final analysis, capability depends upon the energy storage capacity and the ability to turn that energy into useful work. •



CIP

management's new cost-cutting tool

By Tom Johnson, associate editor

- **With this new system,** you can (1) develop real cost-consciousness in your management personnel and (2) channel their creative ideas into cost-cutting areas
- **It's called CIP**—for Cost-Improvement Program. Since 1956, it has saved $7-million for an American Bosch-Arma plant
- **It works this way:** Cost-improvement proposals from management personnel receive a formal, exhaustive review by an objective group. CIP is definitely not the usual sort of suggestion plan

American Machinist / *Metalworking Manufacturing* Special Report No. 504 • April 3, 1961

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CIP

Just how effectively can individuals contribute to a plant's cost-improvement program? The following proposals show what can be done:

- J M Palmer (Machine Shop): "Manufacture air gages instead of buying them." Annual saving—$7788.
- L Cordiano (Precision Assembly): "Eliminate use of nylon gloves in the precision-assembly area." Annual saving—$12,450.
- C O Jackson (Product Quality): "Eliminate purchase of reference computers for 107A testing." Annual saving—$363,359.
- R T Harding (Engineering): "Put reference documents for standards on 35-mm slides." Annual saving—$72,676.
- M Thompson (Manufacturing): "Change procedure for machining bushing, from turret lathe to automatic screw machine." Annual saving—$619.

These proposals are but a small sampling of hundreds submitted—and adopted — every year at the Arma Division plant (Garden City, NY) of American Bosch-Arma Corp. Some save vast sums, others contribute only a few hundred dollars to cost improvement. All receive equal attention.

Collectively these individuals proposals have paid off spectacularly: $7 million saved in four years since the start of this unique system.

This is only the beginning, Arma officials feel. For 1961 and the future, they have raised their sights appreciably. The goal this year: $2.5 million. In a plant that employs some 5500 people, this represents a saving of about $450 a man. And there is every indication that this quota will be surpassed, just as it was last year (over $3-million saved, although the quota was $2.3-million —see chart, previous page).

How CIP works

Arma calls its system CIP—for Cost-Improvement Program. In general, it works this way:

When anyone in management has an idea that may improve operating costs, he fills out a form (called a CIP—see illustration, p 106-7), on which he describes the present way of doing things, outlines a proposed new method, and lists the improvement that should result.

Now the filled-in form goes to Industrial Engineering, where the Standards and Cost-Improvement Section conducts an investigation (with the affected department) to establish just how practical the proposal is. If the suggested change looks promising, the I E Dept prepares (on the back of the CIP form) a cost analysis of both present and proposed methods, to determine the annual savings that the change would bring.

When the investigation and cost analysis are completed, the CIP goes before a committee, composed of representatives from major plant departments, which accepts or rejects the proposal (or asks for more data).

Following the decision, the individual who submitted the proposal is informed, and the departments affected receive instructions to install accepted CIP's as soon as practicable.

What all the foregoing adds up to is this: A formal system for submitting, evaluating, and installing management proposals that will cut operating costs. The key words here are **formal system.** For here is no loosely handled suggestion program, but a thorough-going method for exploring all avenues that may lead to cost improvement.

The man who submits a CIP knows that, before it is accepted or rejected, his proposal will receive an exhaustive, objective scrutiny. He also knows that (because someone else will make the investigation) he won't have to spend half his working time tracking down facts to support the proposal.

History of program

The cost-improvement program at Arma began in 1956, shortly after Charles W Perelle became president of the parent corporation, American Bosch-Arma. Perelle, seeking ways to shave excess operating costs and at the same time anticipating future government demands for cost conservation, decreed the establishment of CIP as a matter of corporate policy. Today all corporate divisions have—or will soon have—programs.

Arma's principal product is just about the most exotic imaginable: the inertial guidance system, and associated ground-support equipment, for the Atlas missile. All the division's work, in fact, is on U S government defense contracts. In this respect, the company is particularly proud that it inaugurated the CIP system *before* the Air Force began its program for "More Hardware Per Dollar" from defense contractors.

Outside response to the program has been enthusiastic. Other defense contractors in the area have asked for, and received, special seminars on the CIP system. And Air Force officials want to install it in other companies with which they do business.

Inside response has been enthusiastic, too—from the highest level of management on down. Clayman C Shafer, manager of Industrial Engineering, the man who has guided the program since its inception, says: "From the beginning, we've had the enthusiastic support of top management. In fact, without this wholehearted encouragement, the program would not have developed into the healthy, dynamic program we now have."

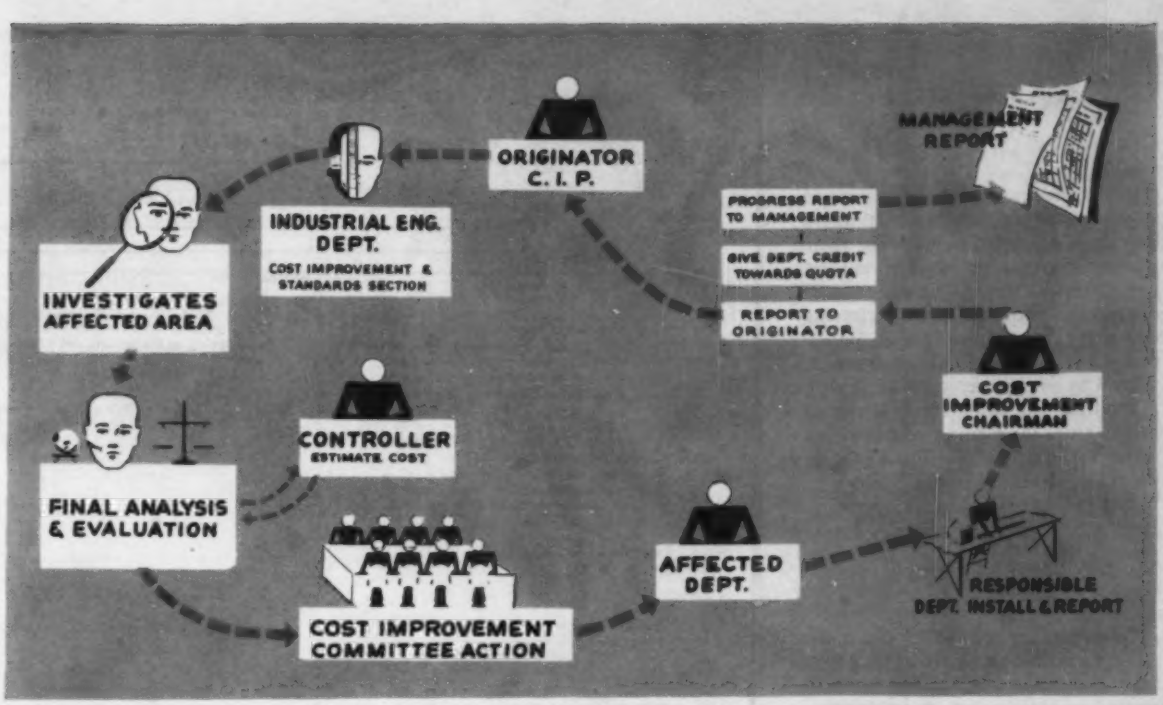
Management personnel below the summit also find the program to their liking, because it acts as a sounding board for their creative ideas, which otherwise might not find expression. Unlike many company plans, there is no cash award here for accepted CIP's. What the originator of a cost cutting idea does get is something of far greater potential value: recognition for his superiors.

When a CIP is accepted, the originator gets a formal memo of acceptance, presented by his department manager. A copy of this memo goes into his personnel folder, where it is available when reviews for promotions and merit increases come up.

Why no monetary rewards? Explains Shafer: "That's a question we're frequently asked. Actually, we feel that cost-consciousness is every management man's business—just as much a part of his daily routine as getting his job done. And because we restrict participation to management personnel, cash awards aren't as important in the long-run as recognition."

Only management personnel *on the supervisory level and above* are eligible to participate in the program. Below this level, a separate suggestion plan (similar to those in other companies) provides cash awards for accepted suggestions from wage earners. Incidentally, these employee suggestions *are* eligible for considerations in the CIP program, but only if they contribute directly to cost improvement. Otherwise the two programs are completely separate.

Arma maintains an open-door policy in its program. The originator of a CIP submits it directly to Industrial Engineering, not through his superior. The object is not, of course, to deliberately circumnavigate the



Originating a CIP sets off a complex sequence of investigation, analysis, and cost evaluation. Every proposal submitted at Arma receives this detailed attention. Turn to the next page for a look at a typical CIP proposal

boss, but to remove any potential obstacles to the free flow of creative ideas.

Cost improvement targets

The CIP program thrives on competion, a key element in its success. Each plant department gets an annual CIP quota. And no one in the plant is allowed to forget it. Widely distributed monthly reports show what percentage of each department's quota has been realized to date.

"In the beginning," reports Frank J Morgan, head of the IE Standards and Cost-Improvement Section, "quotas were not an integral part of the program. We soon realized that they are necessary. Without a quota, it is impossible to measure performance. With a quota, each department has something to strive for."

Quotas are set up in the following way: At the beginning of the year the Industrial Engineering Department meets with each department manager and establishes annual quotas. For the last few years, this quota has amounted to 3% of actual operating costs for the previous year. The only exception is the Purchasing Department, whose savings quota is 2% of last year's material expenses.

These quotas are realistic, that is,

THE ARMA COST-IMPROVEMENT PROGRAM

WHAT IS IT?

A participation program for executive, administrative, and supervisory personnel.

WHAT ARE THE OBJECTIVES?

- Provide a systematic way to submit, evaluate, and install proposals for cutting operating costs.
- Stimulate creative thinking in all areas of managerial responsibility.
- Develop a more efficient, more economical operation.
- Measure participation and performance against division-wide plans for cost reductions.

WHO ADMINISTERS IT?

The Industrial Engineering Department.

HOW DOES IT WORK?

An individual with a cost-improvement idea fills out a special form, detailing the present method, his proposed method, and the expected improvement. He submits this to Industrial Engineering, which makes a thorough investigation of the proposal.

WHO MAKES THE DECISIONS?

A Cost-Improvement Committee, composed of representatives from major plant departments, examines each proposal, then accepts or rejects it.

HOW ARE INDIVIDUALS REWARDED?

The originator of an accepted proposal receives a letter of recognition from top management; a copy is filed in his personnel folder.

CIP

the 3% cost reduction may be revised upward or downward, depending on conditions in a department. If, for example, a department expects large unavoidable expenses during the coming year, the 3% figure may be too high. Or it may be too low if, say, new equipment is expected to cut operating costs sharply.

Totaling the quotas of all departments gives the desired cost improvement for the entire division. Every month a chart (like the one on the first page of this article) shows actual versus targeted savings for the year to date.

Originating a CIP

One feature of CIP, mentioned earlier, needs to be re-stressed: In the program, each proposal submitted receives **analysis in depth.**

The best way to illustrate this point is to trace—step by step—the complex sequence that is set into motion when someone has a cost-improvement idea. What follows is a description of an actual CIP, from idea to official acceptance:

Some time ago machine shop superintendent John Palmer felt he could solve a problem that had bothered him for weeks. Once he had worked out his solution, he filled out a CIP form, detailing the present method, his proposed one, and the expected improvements (see right).

Filling out the form took only a few minutes. What Palmer did in this short time was to shift the burden of investigation, analysis, and cost evaluation from his busy back to the Industrial Engineering Dept.

Palmer's headache: Reworking of faulty by-pass valves, used in the hydraulic system of the B-52 fire-control system, was too costly and time-consuming. Only a nominal percentage of valves failed to survive testing, but the time and money spent on reworking the rejects were significant.

Here the culprit was a high-pressure leak that developed on some of the valves during testing.

Engineering specs required that the valve operate under 3200-psi pressure, so testing was to 5000 psi. Some of the valves simply would not take these pressures. Between 1000 and 3000 psi, the rejects started leaking—in every case around a plug that had been inserted in a hole. (This innocent-looking hole was drilled to permit boring a blind hole between two chambers in the heart of the valve; the plug's function was simply to close up the "convenience" hole.)

Let's examine the complicated rework cycle the Palmer felt could be changed:

- Drill out the plug, to prepare the valve for a new sealing operation.
- Carry the valve from the drill-press area to the jig-bore area.
- Jig-bore (to ± 0.0001-in. tolerance) a hole 1/64 in. larger than the original.
- Preheat the valve, then press-fit (with an arbor press) a centerless-ground aluminum pin into the hole.
- **After all this precision work, hammer (by hand) the pin into place!**
- Carry the valve to the milling department.
- With a fly cutter, remove 0.005 in. from the top of the valve and the plug.
- Retest the valve, and if still unsatisfactory, scrap it.

Here was Palmer's solution: Use a

STANDARDS & COST IMPROVEMENT SECTION
MAR 3 1958
1:22 PM
DATE & TIME RECEIVED

COST IMPROVEMENT PROPOSAL (BE SPECIFIC)
DATE
C.I.P. No. 61-8

SUBJECT: By-Pass Valve for the B-52 Fire Control System

PRESENT METHOD

A hole is drilled to permit boring a blind hole between two chambers in the heart of the valve. An aluminum plug, which is centerless ground, is inserted into the convenience hole in order to seal the opening. The process is as follows.

1. Drill hole
2. Bore hole 1/64 larger to ±.0001 tolerance
3. Arbor-press plug as far as it will go
4. Hammer plug the rest of the way in
5. Fly-cut excess material off the plug
6. Centerless-grind plug to close tolerance to match bored hole

Repeat above for rework cycle.

PROPOSED METHOD

Use a pin plug. This consists of an aluminum plug, ground on the outside, and a taper pin which is forced into its inside diameter.

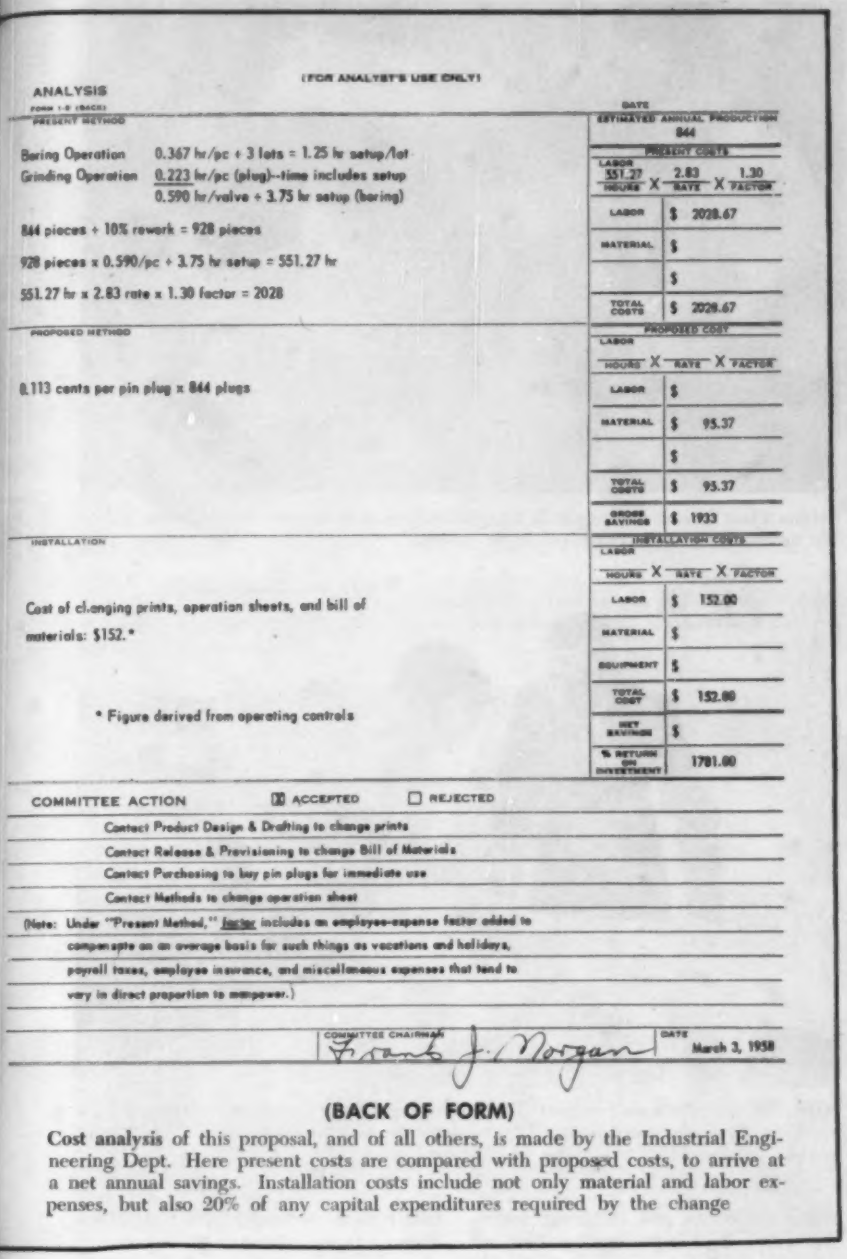
ANTICIPATED IMPROVEMENT

Eliminate boring operation
Eliminate grinding insert
Eliminate rework due to leak at plug point
Shorten travel distance of valve in the shop

ATTACH ADDITIONAL SHEETS IF REQUIRED

(FRONT OF FORM)

This cost-cutting proposal, submitted by the machine-shop superintendent, resulted in annual savings of $1781. See text for a detailed description of the proposal, from origin to acceptance



ANALYSIS (FOR ANALYST'S USE ONLY)

DATE

PRESENT METHOD

ESTIMATED ANNUAL PRODUCTION: 844

Boring Operation 0.367 hr/pc ÷ 3 lots = 1.25 hr setup/lot
Grinding Operation 0.223 hr/pc (plug)--time includes setup
0.590 hr/valve ÷ 3.75 hr setup (boring)

844 pieces + 10% rework = 928 pieces

928 pieces x 0.590/pc + 3.75 hr setup = 551.27 hr

551.27 hr x 2.83 rate x 1.30 factor = 2028

PRESENT COSTS

	HOURS	RATE	FACTOR	
LABOR	551.27	2.83	1.30	$ 2028.67
MATERIAL				$
				$
TOTAL COSTS				$ 2028.67

PROPOSED METHOD

0.113 cents per pin plug x 844 plugs

PROPOSED COST

	HOURS	RATE	FACTOR	
LABOR				$
MATERIAL				$ 95.37
				$
TOTAL COSTS				$ 95.37
GROSS SAVINGS				$ 1933

INSTALLATION

Cost of changing prints, operation sheets, and bill of materials: $152.*

* Figure derived from operating controls

INSTALLATION COSTS

	HOURS	RATE	FACTOR	
LABOR				$ 152.00
MATERIAL				$
EQUIPMENT				$
TOTAL COST				$ 152.00
NET SAVINGS				$
% RETURN ON INVESTMENT				1781.00

COMMITTEE ACTION ☒ ACCEPTED ☐ REJECTED

Contact Product Design & Drafting to change prints
Contact Release & Provisioning to change Bill of Materials
Contact Purchasing to buy pin plugs for immediate use
Contact Methods to change operation sheet

(Note: Under "Present Method," factor includes an employee-expense factor added to compensate on an average basis for such things as vacations and holidays, payroll taxes, employee insurance, and miscellaneous expenses that tend to vary in direct proportion to manpower.)

COMMITTEE CHAIRMAN Frank J. Morgan DATE March 3, 1958

(BACK OF FORM)

Cost analysis of this proposal, and of all others, is made by the Industrial Engineering Dept. Here present costs are compared with proposed costs, to arrive at a net annual savings. Installation costs include not only material and labor expenses, but also 20% of any capital expenditures required by the change

pin plug (instead of the centerless-ground aluminum one) to seal the hole.) A catalog item, it can be bought off the shelf from vendors all over the country. The two-piece part consists of an aluminum plug, grooved on the outside, into which a taper pin is forced.

If his proposal were feasible, Palmer reasoned, and if it would lead to a cost improvement, there would be several advantages over the present method: The expensive jig-boring operation would be eliminated; no centerless grinding of the plug would be necessary; the valve would not have so much time-consuming travel about the shop; and, best of all, the problem of leaks around the valve's plug would disappear.

Submitting the CIP

Once his ideas were on paper, all Palmer had to do was drop the CIP in his outgoing mail basket. At its destination (the Standards and Cost-Improvement Section of Industrial Engineering), a secretary logged in the CIP, assigning a number (in this case, 61-8) and stamping the time and date on the form. Then, tearing off an acknowledgement slip at the bottom of the form, she mailed it to Palmer. The CIP was officially "in the mill."

Now the form went to the key administrator of the program: the CIP analyst of the Cost-Improvement Section. This man—and at Arma only one man administers this portion of the program—has the full-time job of impartially investigating every aspect of each CIP submitted.

Analyzing the CIP

After reading the CIP, the analyst's first step was to pay a visit to Palmer. Both men went over the proposal in detail, making certain that no key facts had been omitted. Now both men visited the foreman of the Bench Department, where the trouble was actually occurring. Here, the analyst could fully realize the problems involved in inserting the present plug. Here too he got data on rejections caused by leaking valves.

Next stop for the analyst was Product Quality, where he learned that about 10% of the valves leaked during hydraulic pressure tests. Experts now concurred with Palmer's feeling that the rejection rate was too high, and suggested that Engineering be contacted, to determine if the new proposal would meet with their approval.

Then the analyst checked with the Product Design Department, which agreed that further action needed to be taken. He was warned, however, that before Engineering would approve a change, test would have to be made with the pin plugs.

The analyst talked to the appropriate project engineer, asking him to get together with Palmer, to outline and set up tests for the new plug. Both men agreed that plugs should be inserted in several sample valves, which would then be sent to Engineering for rigorous pressure tests.

The suggestion worked: In the hydraulic lab, the valves were taken up to 10,000 lb—twice the required test pressure—without leakage. Afterwards, an examination by Quality Control showed that the valve material had actually flowed into the pin-plug grooves, making a hermetic seal. And in further tests the valves withstood pressures as high as 15,000 psi, as much as the testing equipment could generate.

Analyzing costs

Once he knew the new method would work, the CIP analyst was

CIP

ready to find the answer to this question: Would the savings be large enough to warrant a change to the new proposal? This was the critical part of his investigation.

A visit to Production Control told him how many valves still had to be made, and what their production schedule was. He discovered that production would continue for some time, and that future demand certainly dictated a change to the new method. (If only a few valves had been scheduled, the CIP might have been held in abeyance, with Engineering merely noting the change for future reference.)

Now the analyst was ready to make a cost analysis of both the present and proposed methods. After determining total costs for each, and deducting the cost of installing the change, he found that (if Palmer's suggestion were adopted) the net savings a year would be $1781. He then entered this cost analysis on the back of the CIP form (see p 107).

Judging the CIP

At this point Palmer's original proposal, thoroughly analyzed, was ready to be presented for acceptance or rejection. At the next weekly meeting of the cost-improvement committee, CIP 61-8 was brought up for consideration, along with several others that had been investigated in the same way.

To the committee, composed of experienced representatives from major plant departments, the analyst presented his evaluation and recommendation on CIP 61-8. So that the committee could better understand the proposal, he showed two cutaway valves—one with the old aluminum-rod plug, the other with the new pin plug.

After viewing the samples, and considering the evaluation, the committee took a vote: CIP 61-8 was accepted, and instructions were given to install it at the earliest practicable time.

Putting the CIP to work

After the vote of acceptance, the committee chairman informed Palmer, sending the memo through Palmer's superior.

Industrial Engineering now prepared an engineering-change request, directing that the new method be adopted at once. This request went to Design and Drafting, where the valve drawings were pulled out and changed.

Now other departments could take action: Production Control had the authority to order pin plugs; in Tool and Process, operation sheets were converted to reflect the change; and new shop orders went to the Machine Shop. CIP 61-8 was now a reality, and so were the savings.

Before: Plant Layout drew to scale a complete layout of an area. Any change in layout meant messy erasures or torn layout sheets

After: Layout now uses templets. These are placed on grid acetate, eliminating the need to draw machinery figures. Corrections are also easier to handle. Estimated annual savings: $7322

Typical CIP's

Not all CIP originators are as successful as Palmer was with his pin-plug idea. But a surprisingly large percentage of proposals do get accepted. Arma officials estimate that about 30 to 35% of all CIP's eventually are accepted and installed. When one out of every three creative ideas in a plant pays off in proved savings, the batting average must be considered high.

Some proposals are much more complex than the one just described, some much simpler. All receive the same careful, detailed analysis. Here are a few typical CIP's that have been accepted recently, with descriptions of the old method, the proposed method, and the improvement that each produced:

Assembling printed circuits

OLD: Printed-circuit boards were assembled with an operating sheet and a blueprint as guides. Rejects

Before: Components for printed-circuit boards were bent with small fixtures that worked like a sheet-metal brake. Bent one at a time, they had to be loaded and unloaded, carefully and laboriously, by hand

After: A multiple bender was bought in lieu of an order for 16 more hand-bending fixtures—at one-third the cost. The new unit does the work of 38 hand fixtures and three operators. Estimated annual savings: $16,726

Before: Liquid nitrogen came into the sterile room in five good-sized cans. A production worker had to sign in at the security desk, don sterile garb, and bring the cans through air locks to the sterile room

After: Liquid nitrogen now is piped, from an outside alley, into the sterile room through a jacketed tube. Estimated annual savings: $2119. The savings in time and convenience to workers are just as important here

were high, because components were put in the wrong places, or their polarity was reversed. There was also no decrease in learning-curve expenses, because production was limited and, working on about 200 different types of boards, assemblers could not become familiar with them.

PROPOSED: Use a full-size color transparency and an inexpensive viewer. Assemblers would no longer have to interpet color codes from numbers on the operation sheet, but could simply duplicate what they see on the viewer.

IMPROVEMENT: A 30% jump in work performance was reported by the time-study group. There was a marked decrease in assembly errors. Annual savings: $9646.

Continuity check

OLD: A continuity check with a buzzing rig was performed, under the auspices of Product Reliability, by two people from Manufacturing, who had to read wire designations from a schematic drawing.

PROPOSED: Make a plug-in cable, with ending points located on a single board.

IMPROVEMENT: Only one operator is required to buzz the unit, and he doesn't need to follow the drawing. Estimated annual savings on one of these rigs: $7427.

CIP

Soldering printed circuits

OLD: Printed-circuit boards were dip-soldered by this process: Flux-coat the bottom side . . . wait for the flux to dry . . . place the board into a fixture . . . attach a timing wire to the fixture . . . dip the fixture and board into molten solder for a specified time. This process gave poor results, because solder-flow up into the through-drilled holes in the board was not satisfactory.

PROPOSED: Install a flow-solder machine. The machine moves a cart at a designated rate over a flux wave, a drying coil, and then over a solder wave.

IMPROVEMENT: All the operator has to do is load and unload the fixture. Net annual savings: $116,639.

Reclaiming freon

OLD: In the sterile room (a dust-free decontaminated area) gyro parts are cleaned with freon. After limited use, the freon was thrown away.

PROPOSED: Make a freon reclamation rig.

IMPROVEMENT: The rig returned for re-use about 95% of the freon. The complete system was installed in the sterile room, so that only occasional refilling of the cycle is necessary. Estimated annual savings: $24,639.

No smoking, please

OLD: In a new premision-assembly area, policy forbade any smoking or consumption of edibles. Just off the area, a smoking and coffee room was set up—a reversal of policy for four similar (and older) areas in the plant. As a result, work performance dropped, because out-of-work-area time increased.

PROPOSED: Industrial Engineering should conduct a work-delay study of the area. (The CIP was submitted by the factory manager.)

IMPROVEMENT: The study showed that abolishing the smoking area would increase work performance, also free valuable floor space. Estimated annual savings: $199,693. Another benefit: Better morale at the other four precision-assembly areas.

The CIP committee

Because the cost-improvement committee exercises life-or-death jurisdiction over every proposal, its work should be examined in detail.

Meeting once a week (usually for about two hours), the committee passes judgment on all CIP's that the I E Dept has evaluated and cost-analyzed. At most sessions, seven or eight members are present, from such departments as Manufacturing, Engineering, Product Design, Tool and Process, and the Controller. Each member is authorized to act freely for his own department.

Chairman of the group is Frank Morgan, head of the I E Standards and Cost-Improvement Section. Reports Morgan: "We insist on regular meetings — rain or shine — every week. And we also like to emphasize that the committee isn't regularly convened simply to act as a rubber stamp for the findings of the analyst, Industrial Engineering, or any other department. No matter how good a proposal looks, it doesn't get anywhere unless the committee approves it."

At the sessions, the analyst presents each proposal to the committee, explaining in detail its cost breakdown and advantages (or disadvantages). He may also bring in other plant personnel to help put his points across. Or he may prepare "before" and "after" samples of assemblies and parts to show to the committee.

Often the committee wants still more information on a proposal. Here, judgment is deferred until the next meeting. Otherwise, each CIP is accepted or rejected—by majority vote.

Once the committee accepts a CIP, its installation becomes an executive order. The committee chairman initiates the necessary paperwork, giving instructions to the affected departments and notifying the originator of the proposal. Members of the committee are responsible for coordinating any action required in their departments.

If a CIP has been rejected, the originator is promptly informed, and given the reasons for the rejection. These CIP's go on file and retain priority over similar proposals for one year. When the originator of a rejected CIP wants his proposal to be reconsidered, he can submit a request (together with any additional data) to the chairman of the committee.

Cost consciousness

"Besides the savings, the greatest benefit of the program is the healthy way that it simulates cost consciousness in management and supervisory personnel." This is the happy experience of one of CIP's most enthusiastic supporter, E D Gittens, corporate vice president and Arma Division manager.

But cost consciousness is, as CIP officials know, purely a state of mind. To be kept a'ive, it needs constant attention. For this reason, the division conducts vigorous publicity campaigns to keep the program in the limelight. As in so many management schemes — profit-sharing plans, value-analysis programs, cost-reduction systems—half the battle lies in constantly keeping personnel informed.

Here are some of the ways in which Arma keeps the spotlight on CIP:

- Frequent letters from the division manager urge continued participation in the program.
- New supervisors receive training courses in CIP techniques.
- Talks on CIP are given at departmental staff meetings.
- Minutes of weekly CIP committee meetings receive wide distribution.
- Monthly reports show, for each department and for the division, performance against quotas. They also give resumes of individual CIP's that have been accepted.
- Posters distributed throughout the plant advertise the program.
- In the Arma bi-monthly newspaper, frequent articles tell of the program's latest accomplishments.

It is impossible, Arma officials feel, to overstress the value of these communication techniques. For a successful CIP system requires constant priming if there is to be a constant flow of savings. And the company doesn't want its personnel to forget this. It believes in constantly reminding managers and supervisors that their creative ideas **can** be put to work. •

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Grade Markings for Bolts—I

Grade markings on bolt heads identify material, strength and the specifying group or user. These markings serve as a quick visual check of the product upon receipt. They also aid the assembly operator to install the correct grade of fastener

By Frank W Wood, Jr, Advanced Designs, Inc, Vienna, Virginia

Carbon-Steel Fasteners

Markings	Specifications	Used by
C	Low-carbon 60,000 YS*	Army Ord.
60	Commercial steel 48,000 TS† Fine-thrd, hex-hd bolt	Air Force
65	Commercial steel 48,000 TS Coarse-thrd hex bolt	Air Force
70	Commercial steel 48,000 TS Carriage bolt	Air Force
E4	Low-carbon (AMS 5061-cold drawn) 70,000 TS; Rh B80-100	Air Force
	Medium carbon, SAE Grade 3 110,000 TS up to ½" 100,000 TS over ½"	SAE & Army Ord.
B	Medium carbon 75,000 YS	Army Ord.
	Medium carbon Grade 5—SAE Mil-B-857A, ASTM A325 120,000 TS to ¾" 111,000 TS over ¾" 105,000 TS over 1" 90,000 TS over 1½"	Military, SAE Navy BuShips, ASTM
	Medium carbon SAE Grade 6 140,000 TS to ⅝" 133,000 TS over ⅝"	SAE & Army Ord.
E	Medium carbon 95,000 YS	Army Ord.

* YS = yield strength

† TS = tensile strength

Alloy-Steel Fasteners

Markings	Specifications	Used by
	Medium-carbon SAE Grade 7 130,000 TS	SAE & Army Ord.
	Medium-carbon: 150,000 TS—Grade 8 SAE or Mil-B857A	SAE, Military Navy BuShips
	Quenched & tempered— ASTM A354, Grade BD 150,000 TS— Grade 8 125,000 TS over 1½"	ASTM Military

(Continued on page 113)

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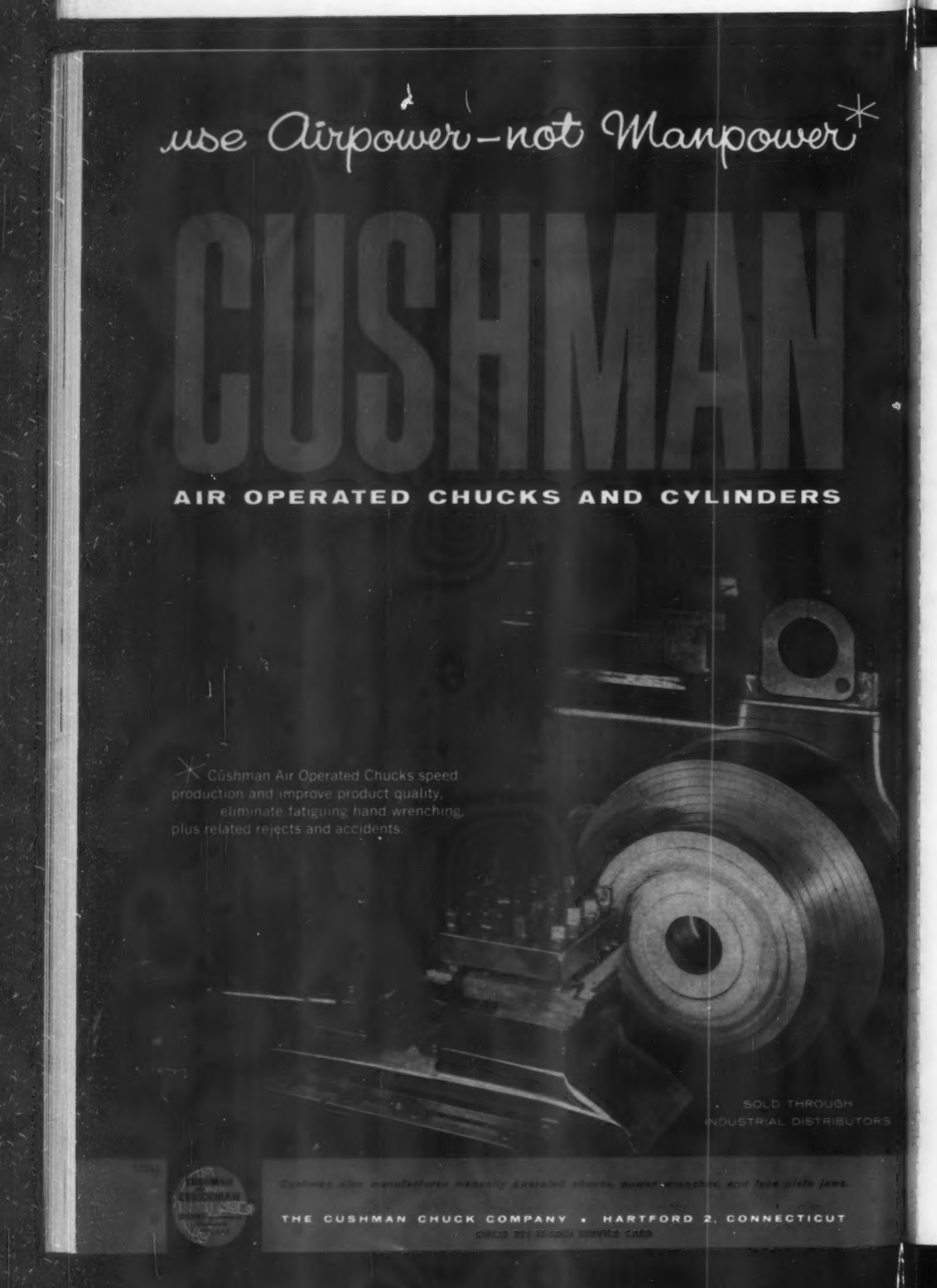

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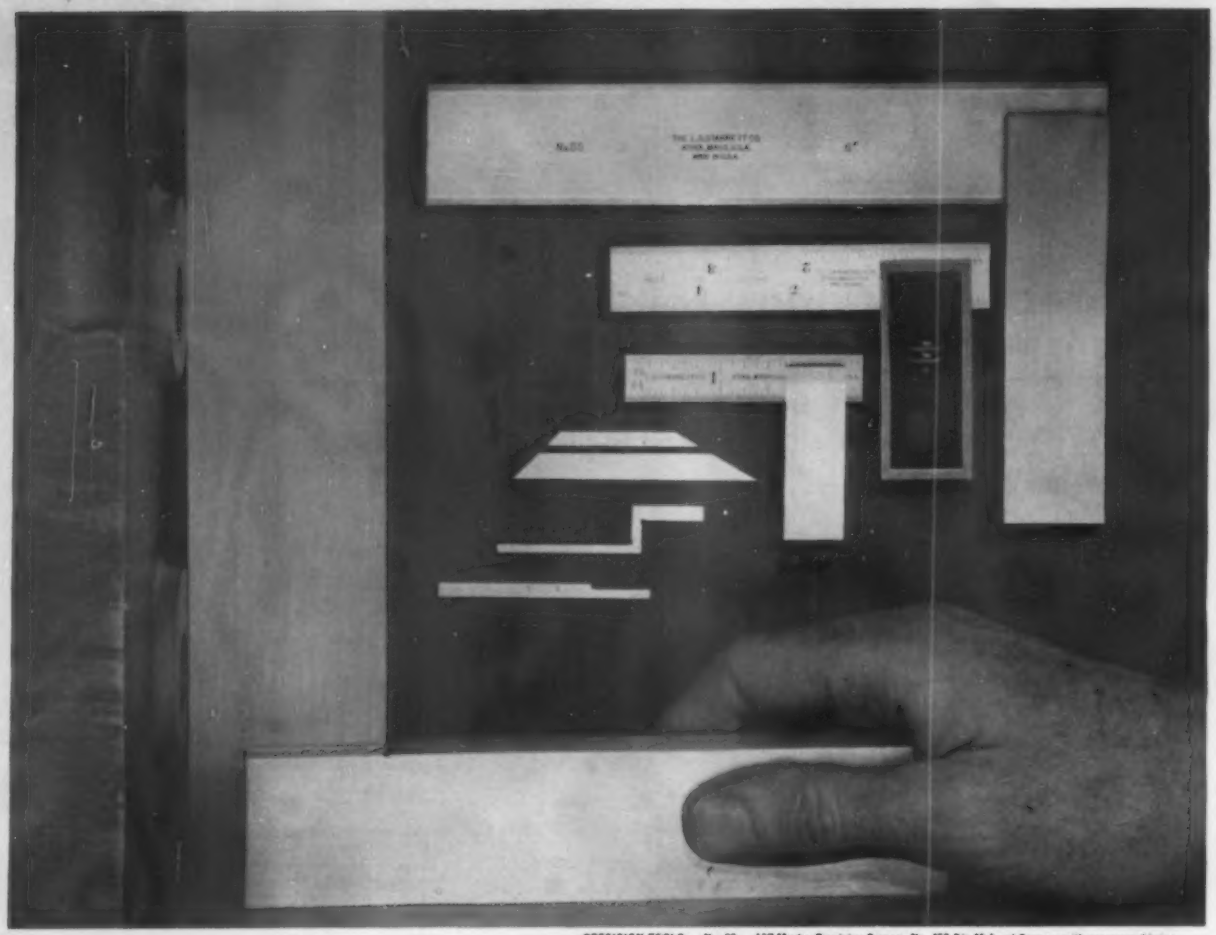
Grade Markings for Bolts—II

Alloy-Steel Fasteners—*Continued*

Markings	Specifications	Used by
	Quenched & tempered ASTM A354, Grade BB 105,000 TS up to 2" 100,000 TS over 2"	ASTM
	Quenched & tempered ASTM A354, Grade BC 125,000 TS to 2½" 115,000 TS over 2½"	ASTM
	Alloy steel 130,000 YS	Army Ord.
	Medium carbon AMS 6320 Rh: C 26-32	Air Force
	Medium carbon AMS 6322 Hex bolts—Rh: C26-32 Socket bolts—Rh: C32-36	Air Force Army Ord.
	Medium carbon, AMS 6322 Rh C26-32	Air Force
	Medium carbon (Cr, Ni, Mo) Mil-B-6812 125,000 TS	Air Force Army Ord.
	Medium carbon (Cr, Ni, Mo) Mil-S-7839 125,000 TS	Air Force
	Chrome-moly 4140, 4142, 4145 105,000 TS to 2½"	ASTM

Markings	Specifications	Used by
	Chrome-high moly Grade B7A (A193) 125,000 TS to 2½"	ASTM
	Chrome-moly-vanadium Grade B14 (A193) 125,000 TS to 2½"	ASTM
	Chrome-moly-vanadium Grade B16 (A193) 125,000 TS to 2½"	ASTM
	Chrome-moly Grade L 7 (A320) 4140, 4142, 4145 125,000 TS to 2½"	ASTM
	Nickel steel AISI 2340 Grade L 9 (A320) 125,000 TS to 2½"	ASTM
	Nickel steel AISI 2317— Grade L10 (A320) 70,000 TS to 4"	ASTM
	Nickel-chrome-moly AISI 4340 or Grade L 43 (A320) 125,000 TS to 4"	ASTM



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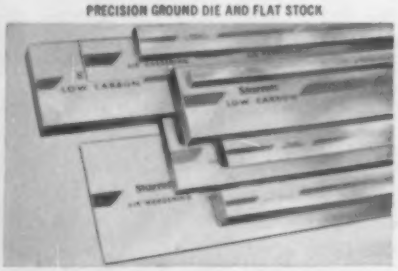
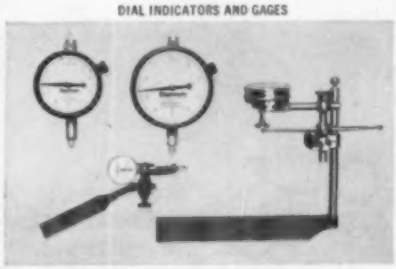


HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

DIAL INDICATORS AND GAGES



Talking Shop

Use for Old Guns

BARRELS OF 16-IN. GUNS from dismantled battleships make fine pressure chambers for powder metallurgy. Tungsten exhaust throats for jet engines are made by the GE Lamp Metals & Components Dept by hydrostatic pressing in the old gun tubes. Pure tungsten powder is placed in watertight molds and then subjected to liquid pressure of 25,000 psi. The cold pressed powder is then sintered.

Size of ingots that can be produced is limited only by the bore of the gun: 12 in. dia by 60 in. long. Molybdenum is also processed in the gun tubes.

Automatic Tester

AN AUTOMATIC ANALYZER that will predict the performance of a missile has been developed by Hughes Aircraft. The drum-programmed automatic tester (D-PAT for short) includes a digital computer and detects and isolates malfunctions in the missile system. The measurements the analyzer makes are compared with those in the memory drum as the tester runs through the checklist.

If a malfunction is found, the D-PAT flashes repair instructions on a 15-in. screen (these come from a stock of slides in the analyzer). A red arrow is projected onto a circuit diagram to show the component that is causing trouble.

Faux Pas

A BATTLE over ten dollars seems to have had something to do with starting the patent litigation that filled the incandescent lamp business some 30 to 40 years ago. In his autobiography, Charles Eisler tells how when he was Chief Engineer of the equipment-engineering department at the Westinghouse Lamp Co there was a bonus of $10 to every employee who punched in on time for 30 days. Eisler spent four days in Cleveland on business, during which he worked both days and evenings.

But he missed his $10 bonus because he had not punched in in Bloomfield on those four days. There was much discussion about it, but the ten dollars was not forthcoming. This seems to have been the point at which his attitude toward Westinghouse began to change. Later he started his own company, supplied machinery to independent lamp makers, and won the patent suit that Westinghouse and General Electric brought against him.

Motley Crew

THERE IS A LARGE element of accident in invention that will keep it from ever becoming a matter only for organized research laboratories. George Eastman was trained as a bookkeeper, Midgely (tetraethyl lead) as a mechanical engineer, and Gillette was a traveling salesman. Kodachrome film was invented by two musicians, the ballpoint pen by a painter, the pneumatic tire by a veterinarian, and the dial telephone by an undertaker. If, says Lynn Williams, "the director of a modern research laboratory had hired this motley crew to work on the kinds of things which they invented, he would have been fired. This element of accident is uncontrollable, unpredictable, cannot be organized."

About Ideas

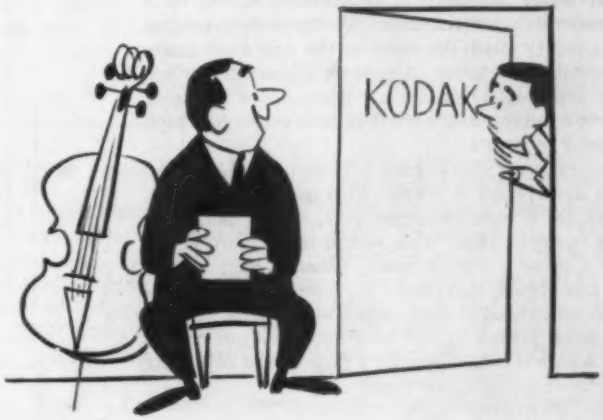
"IT IS NOT DIFFICULT to avoid failure in dealing with new ideas. All one has to do is to reject them."

This notable explanation of the hazard of getting a new idea adopted in a large organization comes from a talk by Lynn A Williams of Anocut Engineering at a recent SAE meeting. We can't summarize all of William's points here, but he emphasizes the need to establish a place to test and try out production processes in a secluded area of the factory that is insulated from the daily pressures. He concedes personal feeling because the Anocut process has done best in companies where such facilities exist.

There is a natural war between the innovators and the organizers. The innovator is likely to have new ideas not only in the areas where they are wanted, but in the areas where they are not wanted. Williams feels that in the U S today, the organizers are getting too far ahead in their war with the innovators and our progressivism is in danger of becoming a tradition rather than a fact.

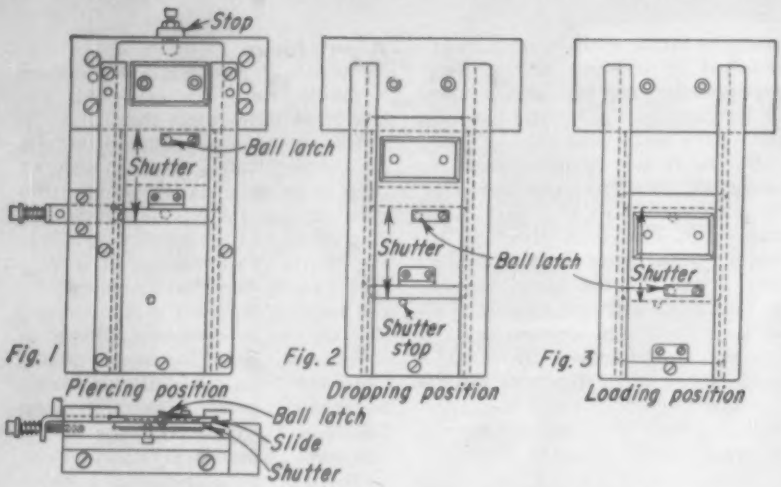
Eye Catcher

A HEADLINE that caught our eye in the February issue of Ex-Cell-O Tool Tips: "Often 5 out of 6 operations may be combined." The story is a reminder that boring, reaming, facing, and chamfering operations can often be combined in a single special cutter to save direct labor. •



Practical Ideas

Shuttle Feed Promotes Safety—Increases Speed



Even if this die should be hand fed, the shuttle feed will increase production and virtually eliminate serious accidents. The higher speed is attributed to the fact that though part loading is necessary, unloading the finished product is not; it is all taken care of by the return of the slide. That the shuttle feed makes press operation safer lies in the feature that the operator need never place his hand between open die halves.

Three stages of the feed operation are shown in the drawings. The first, Fig. 1, has the piece part in piercing position. In Fig 2, the part passes an open chute leading to a receptacle, automatically unloading the slide on its way back to loading position. It's this position that Fig. 3 illustrates. Here, the parts can be safely loaded by hand or, for a bit of automation, a magazine feed and a two-way air cylinder can operate the slide.

A shutter plate, directly beneath the slide, supports the part in the slide nest during the loading and until the shutter strikes the die block. The slide continues, however, to an adjustable stop screw which places the part in piercing position. At this point, a ball through the slide, backed up by a leaf spring, catches a socket in the far, or inside, end of the shutter. Now, when the slide is drawn back, the shutter follows the slide leaving the nest without a bottom and the part drops through into the chute opening.

Further withdrawal causes the now projecting shutter to strike a stop screw as shown in Fig. 2. This dislodges the ball from the inside shutter socket and, as the slide is pulled all the way back, shifts it to the outside. The shutter is now in position to support another workpiece as it adds a bottom to the nest.

For a hand-operated shuttle feed, a spring-loaded latch is provided—shown on the left in Fig. 1. It is designed to catch the slide and hold it against the stop screw. Once the holes are pierced, the latch is pulled out to release the slide.

George F Oliver, Richfield Springs, NY

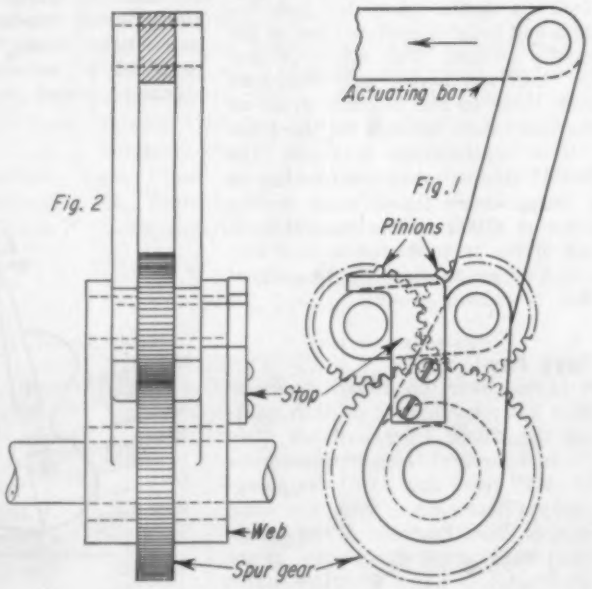
Gear Ratchet Works Smoother with Less Wear

An outstanding feature that distinguishes this mechanism from the standard ratchet wheel and pawl arrangement is the fact that it's practically noiseless. Another is its aptitude for finer adjustments and, finally —and without a doubt most important—its positive engagement.

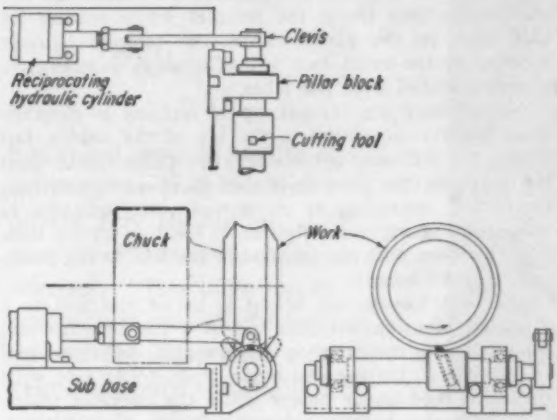
Here, a pair of identical pinion gears replace the pawl, and a spur takes the place of the ratchet wheel, of a conventional ratchet mechanism. The principle behind this idea is pretty much the same as the way back gears lock the spindle in a lathe. A pull on the actuating bar (shown at top, Fig. 1) causes all three gears to mesh, transmitting a motion to the shaft or feed screw to which the spur gear is keyed.

The two pinions ride on pins between two L-shaped plates and are always in mesh. Also in constant mesh, maintained by a web in either side, is the pinion at right with the spur gear. This leaves the pinion on the left to, in a sense, serve as pawl. When a push on the actuating bar occurs, this pinion is raised out of engagement until its extended shaft hits a stop. This permits the right-hand pinion to roll to a new location on the spur gear where it is locked with a pull on the actuating bar as all three gears again mesh.

L Kasper, Philadelphia, Pa



Radius-Turning Fixture Cuts Production Time



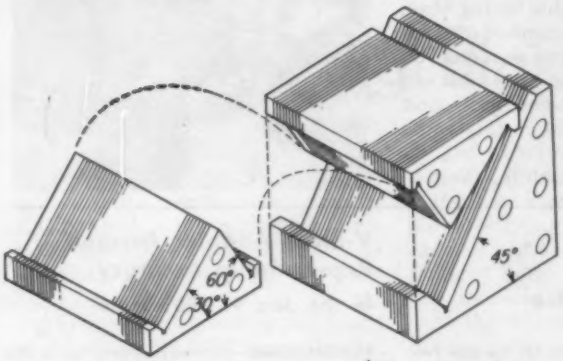
While a worm-gear blank is being faced and bored, a radius is turned on its periphery without special attention from the operator. This is the result of an automatically operated fixture which mounts on a sub base under the boring head. Being hydraulically powered, the radius tool works on the underside of the blank and completes its operation within the facing and boring cycle.

The tool-carrying arbor is supported under the centerline of the work by two pillar blocks keyed to the edge of the sub base. Smoothness of operation is assured by a ball-thrust bearing in each block against which nuts are adjusted to remove end play and locked. The tool hole in the center of the bar is made at a 20° rake angle as the blanks are cast and require only a finish cut.

Attached to the arbor, extending towards the back, is a lever with a clevis on its free end. Into this clevis goes a connecting rod to the hydraulic cylinder mounted on the sub base in back of the boring head. A two-way valve controls the fluid flow to the cylinder, synchronizing it with the other operations. The facing and boring tools are mounted in tool blocks on a regular hydraulic cross slide.

John J Sobanski, Detroit, Mich

Magnetic Angle Blocks Support Work Two Ways



Whether ground to standard precision angles or to angles for specific applications, a set of these blocks is a definite asset to any tool maker's accessory collection. With one mounted on the magnetic chuck, work on production run is loaded and unloaded much faster than when a sine plate is used.

The feature that makes this speedy nesting possible is that each angular surface terminates in a base rib. This gives the part, placed on the block, an additional locating surface just like the edge bar on a sine plate, but without the need for workholding straps.

Illustrated is our method of making two blocks from one cube of alternately laminated brass and steel plates. To make the cube, we stacked 4 x 4-in. plates, cut from end scraps, to a height of 4 in. The end plates should be, at least, 3/16 in. thick and the intermediates anywheres from 1/16 to ⅛ in. Holes for pin rivets were laid out as shown and after being drilled, were fitted with brass pins and rivetted on both ends. Following some milling, all sides were ground square with each other.

Next, the outlines of the two blocks were scribed on one end plate and cut apart on the band saw. Again, a little milling brought the nesting faces within easy grinding of the 30, 45, and the 60° angles on the sine plate.

Otto Unzicher, Peru, Ill

Plastic Tape Stops Scratches

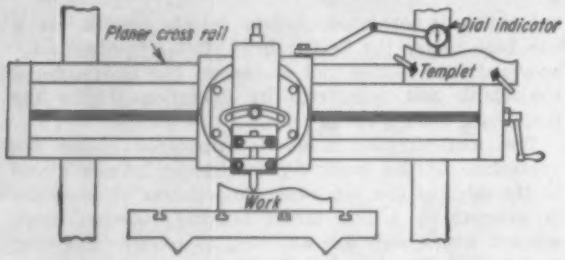
Strips of plastic tape, cemented to the band-saw table, will protect aluminum and other soft material from damage while being cut. Without some kind of buffer between the table and the work, unnoticed burrs or chips could render the workpiece useless.

Teflon tape, therefore, being smooth, slick, and durable enough to withstand a great deal of wear, became our choice as protective material. Strips of this tape, when stretched across the table from front to back and cemented to the table edges, do a fine job of keeping the work unmarred . Any of the all-purpose cements available will do for attaching the tape.

H J Gerber, Stillwater, Okla

Practical Ideas

Tracer Templet Makes Simple Work of Contour Planing



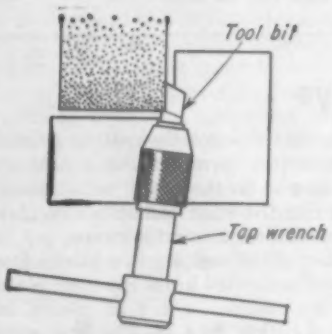
Contour work has long constituted a large portion of our planer output, but the end results usually left something to be desired. Our former method involved laying out the outline of the contour on the workpiece and then, by sight, feeding the cutting tool to that line. Obviously, this could not yield the accuracy sometimes demanded so the tracer templet setup illustrated was adopted.

We now make an accurate template to the required contour and then, as before, scribe an outline on the work—this time using the templet while resting its base edge on the planer table. The templet is next secured to the cross rail with C-clamps so the base edge is parallel with the table.

An indicator arm (made up of sections to simplify adjustments) is secured to the top of the saddle, but before the indicator is mounted, the scribe line is used for roughing the piece to within ⅛ in. of the outline. Once this operation is completed, the indicator is mounted and adjusted—first so its location on the templet coincides with the location of the tool in the work, and then to height.

The best way to set height is to set the tool to a known dimension with the aid of a planer gage and then zero the indicator on the templet. After the tool is backed off, tracing can begin from either side with the cross feed under power while the operator maintains indicator-templet contact.

Lee C Wilkerson, St Louis, Mo



Tap Wrench Holds Short Toolbit For Grinding

Short toolbits, such as are frequently used in boring bars and box tools, are tough to hold while grinding. Not only are they difficult to control, but they also get too hot to handle for any length of time.

The sketch shows a method we use which makes grinding these bits easy. It's an ordinary T-handle tap wrench having a square socket just the right size for the toolbit. Once the bit is inserted and the collar tightened, grinding can proceed without fear of burning the fingers or dropping the bit.

M W Loftus, Chicago, Ill

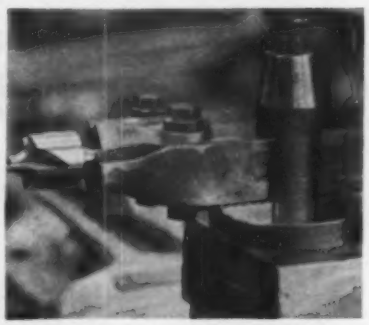
Radius Mill as Turning Tool

Aside from their intended applications, radius mills and ball-end mills can be used in the lathe for machining accurate radii in bores or OD's.

The photo shows how the tool is held in a boring-bar holder, a position in which an internal or external radius is just as easily made. Also, for mill and jig-bore work, the cutters may be held in an adjustable boring head.

The advantage this method offers is simply that rarely can a radius be so accurately made by hand as it can on a radius or ball-end mill. And then you have several cutting edges at your disposal.

John J Cokor, Wickliffe, Ohio



H W Reed Pittsfield, Mass Won $25 for his idea

V-Block Adapter Assures Repeat-Setup Accuracy
in the Jan 9, 1961 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc., and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

Louis Polk

has spent most of his life in splitting the inch "so that others may fly higher, dive deeper, and manufacture more precisely." This devotion to precision in manufacturing has earned Sheffield Corp's 56-year-old board chairman a worldwide reputation for putting the pure science of dimensional metrology to work on the production line

Thinking big about the small

"Divide and conquer" might well be the motto of Louis Polk, who in his 34 years in metalworking has divided the inch into ever-finer units in an effort to conquer the increasingly complex tolerance problems faced by industry.

As executive committee and board chairman of Sheffield Corp, Dayton, Ohio, subsidiary of Bendix Corp, he is in a position to bring the science of dimensional metrology into the shop —Sheffield is a top manufacturer of precision instruments, gages, machine tools, and measuring devices.

"Man's industrial progress is linked to his increasing ability to divide his units of measurements finer and finer." To this concept of technology, Polk has devoted his working lifetime.

Small world

A good title for his biography might well be "The Small World of Louis Polk"—for despite frequent large decisions the world to him is a small place, both geographically and because it is to him reflected in the infinitely microscopic relationship of its parts.

He has spent most of his life harnessing precision to production and has traveled hundreds of thousands of miles in his quest to break the precision barrier.

As the first non-military president of the American Ordnance Association (1959-60), as president of the National Machine Tool Builders Association (1955-56), as a fellow of ASME, as metrology advisor to the National Bureau of Standards, and as chairman of the civilian advisors to the Air Materiel Command, USAF, Polk has been welcomed in the highest industrial and scientific circles here and abroad.

But you'll find him, too, at technical meetings in out-of-the-way places, sometimes as a speaker but more often as a casual visitor.

Here, his warm handshake and his cordial "I am Louis Polk" as he goes from group to group usually manage to touch off impromptu discussions of precision shop problems.

Just recently, Polk returned from Paris, where he served as the only industrial member on the three-man U S delegation to the International Conference on Weights and Measures, when a new World Length Standard was established.

"Short pants" shop boy

Between Paris and his first job in a Dayton tool shop lie more than three decades in metalworking. Actually, Polk's metalworking career goes back quite a spell before that, if you count vacation stints as a "short pants messenger boy" at Dayton's City Machine & Tool Works, in which his banker father acquired an interest. Short pants or no, young Polk was a bit more than a messenger—even though sent for his share of sky hooks and left-handed monkey wrenches when not doing odd jobs and errands.

He has never strayed far from the shop since (except to take a degree from Miami University in Ohio in 1926) even though he is now top executive at Sheffield, and vice president, group executive and a

director of Sheffield's parent Bendix Corp.

Among other directorships are the Winters National Bank & Trust and the State Fidelity Savings Association, as well as past board service on the Community Chest, Chamber of Commerce, Boy Scouts, Salvation Army, and ASME.

His first full-time job, upon graduation from college, was again at City Machine, this time in the design department.

At age 25 and still with City Machine, he showed his talent for salesmanship and management by completing negotiations for sale of a machine tool company on, of all days, "Black Friday" of 1929!

By the time he was named City Machine's general manager in 1931, young Louis Polk's working pattern was pretty well set—a dynamic 12-14 hour day filled with conferences, interviews, business luncheons, board meetings, technical meetings, business homework, and above all, an abiding devotion to precision manufacturing.

Sheffield's first president

In 1934, Polk acquired interest in Dayton's Sheffield Machine & Tool Co, seven years later merged it with Cimatool (renamed from City Machine & Tool) under the name Sheffield Corp, and became first president of the new company.

Always he brought talented engineers and inventors together, encouraging and working with them in a continuous program of product development and refinement.

Out of Sheffield in the ensuing years came, for one thing, the column-type Precisionaire dimensional comparator, probably the world's most universally used air gage, measuring not only metals but textile fibers and paper.

The Precisionaire, incidentally, played no small part in winning World War II's air battles. At Bendix Eclipse, for example, this precision instrument permitted tolerances on B-29 fuel injector plungers to be held within ±0.000,005 inches—greatly minimizing the hazard of fire and failure, which was destroying more planes than the enemy.

The Precisionaire was, of course, only one of many world renowned gaging developments made at Sheffield under Polk, who continued his search for methods and machines to achieve ever-finer tolerances to meet the demands of the then-dawning missile and space ages.

In line with the fast expansion of metalworking following World War II, Sheffield doubled its American facilities and plant size, organized plants in Canada, England, and Australia, and bought out Threadwell Tap & Die Co of Greenfield, Mass.

Then in 1955, Polk brought a dream of many years to reality with the establishment of the Eli Whitney Metrology Laboratory—named for the man whose concept of dimensionally controlled interchangeable parts is said to have laid the foundation for modern mass production methods.

The Whitney Laboratory is the end product of the dedicated mind of Louis Polk, who once said "It is better to have one mind that challenges the future with methodical thought and orderly preparation than a thousand minds which discard and ridicule challenging proposals while voluntarily abdicating the responsibility of making such decisions."

Lest it seem that Polk's dedication to precision has made of him a sort of human micrometer—it is simply not so. His has been a full life, since the days when as a child he watched the Wright brothers trying to get their flying machine off the ground in a pasture outside Dayton.

He and Mrs. Polk are the parents of two children and the grandparents of seven. He is a topnotch bridge player, likes chess, hunting, trapshooting, fishing and sailing.

Many honors have come to Louis Polk in addition to the presidency of NMTBA and the American Ordnance Association—Army Ordnance's Gold Medal, ASTME's Gold Medal Engineering Citation, the Navy Civilian Citation, the Secretary of War's Civilian Citation, membership in Tau Beta Pi engineering honor fraternity, and an honorary doctorate in science from his alma mater, to name a few. But the highest tribute is an informal one from fellow metalworkers, "Mr Measurement."

Names in the News

Chicago Pneumatic Tool Co has appointed **G A May** executive vice president and general manager of **Allen Manufacturing Co**, Bloomfield, Conn, subsidiary which produces Allen hex socket screws and related products. He was formerly general manager of the Oil Tool Division

Borg-Warner Corp has named **Ernest Rackel** vice president, manufacturing, of the Ingersoll Kalamazoo Division. He was previously associated with K W Dart Truck Co, Kansas City, Mo, as plant manager.

Racine Hydraulic & Machinery Inc, Racine, Wis, has named **George A Verhaeghe** vice president, sales. He has been in charge of hydraulic sales for the past several years.

Bausch & Lomb Inc, Rochester, NY, has elected **William A Kerr** a vice president. In addition to his present duties as manager of the Military Products Division, he has also been assigned new duties as B&L management representative for Applied Research Laboratories, a Glendale, Calif, subsidiary

Bostitch Inc, East Greenwich, RI, manufacturer of stapling and wire-stitching equipment, has appointed **Allen G Shepherd Jr** senior metallurgist. Prior to joining the firm he was chief metallurgist at Taft-Peirce Manufacturing Co, Woonsocket, RI.

Yoder Co, Cleveland, has appointed **Elmer A Koenig** vice president, sales. He has been director of sales since 1956.

Black & Decker Manufacturing Co has named **Robert C Tyo** president of DeWalt Inc, Lancaster, Pa, subsidiary. Mr Tyo is former president and general manager of Porter-Cable Machine Co, Syracuse, NY

Detroit Broach & Machine Co has engaged **William C Newberg**, former president of Chrysler Corp, as consultant. Mr Newberg will devote his time primarily to the company's major expansion program which involves diversification within the firm's general field

Foote Bros Gear & Machine Corp, Chicago, has announced that **Roland W Johnson**, vice president, has been given the additional duty of administrative assistant to the president in marketing areas. He will retain his post as vice president and general manager of David Brown-Foote Gears Ltd, Toronto sales subsidiary, and will be based at Foote's Chicago headquarters

Porter-Cable Machine Co, Syracuse, NY, has named **Frank P Maxwell** president to succeed **Robert C Tyo** who has resigned. Mr Maxwell was formerly vice president of Rockwell Manufacturing Co of Pittsburgh.

Westinghouse Air Brake Co has appointed **George W Smith Jr** general manager of the Industrial Products Division. Formerly director of product planning, Mr Smith replaces **Arthur J Bent** who has resigned.

Buffalo Forge Co has named three vice presidents at its Buffalo Pumps Division in North Tonawanda. They are **Bruce W Ellis**, chief engineer of the division; **Adam E Hauck**, divisional sales manager, now vice president, sales; and **Henry D Wilson**, factory manager, now vice president, manufacturing.

Chicago Screw Co, Bellwood, Ill, division of Standard Screw Co, has named **Charles G Mackie** to the new post of chief engineer in charge of new products development. He has been director of engineering for the past six years.

Linde Co, Division of Union Carbide Corp, has appointed **John F Galbraith** manager of electric welding development and planning. He was formerly manager of the Electric Welding Development Laboratory.

American Machine & Foundry Co has named **Zeke R Smith** executive vice president and general manager of **Potter & Brumfield**, a division located in Princeton, Ind. Formerly vice president, marketing and technology, he succeeds **H L Huntsinger** who has resigned.

Denison Engineering Division of American Brake Shoe Co has appointed **Willaim F Bohannan** manager of the new plant to be erected at Marysville, Ohio, which will produce hydraulic axial piston pumps and vales. He is presently chief engineer.

Tool Steel Gear & Pinion Co, Cincinnati, has elected **Sanford M Brooks** president. Formerly executive vice president and secretary, he succeeds the late **LeRoy R Brooks**.

Minneapolis-Honeywell Regulator Co has appointed **J T Pitts** sales manager of its Brown Instruments Division, a producer of industrial process instrumentation. Formerly southwest regional manager, he succeeds **J A Robinson** who has joined the company's six-division Industrial Products Group to coordinate expanding activities in the metals producing areas.

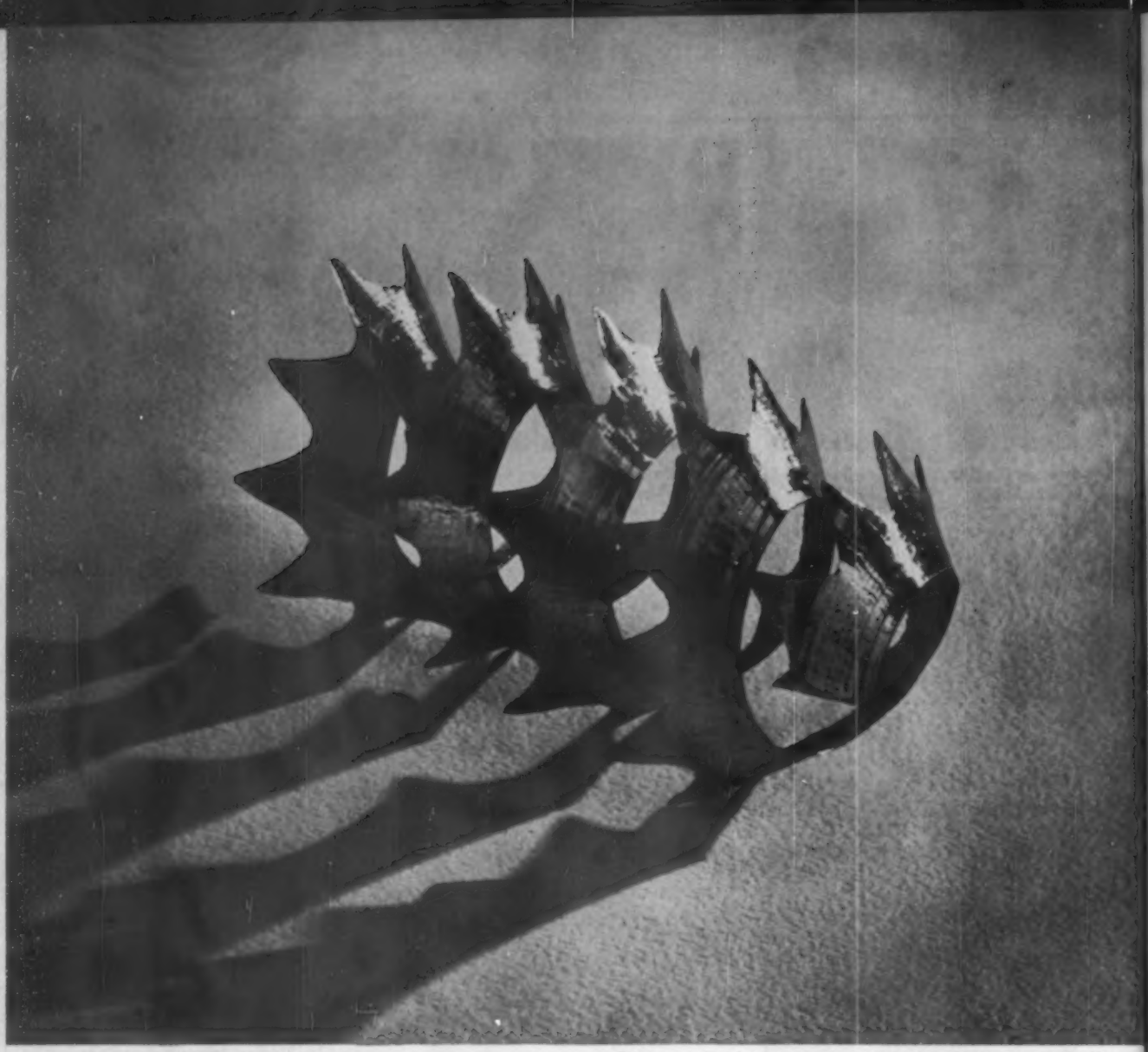
Beryllium Corp, Reading, Pa, has appointed **Edmund M Velten** vice president, production. He was previously general manager of the Nuclear Division in Hazelton

Philadelphia Gear Corp, King of Prussia, Pa, has promoted **William T Brown** from plant manager to vice president in charge of manufacturing

Chrysler Corp has appointed **Frank O Anderson II** plant manager of its American Foundry Plant at Indianapolis. **C S Keller** succeeds Mr Anderson as manufacturing manager of the casting plant at Kokomo.

Randall Co, Cincinnati division of Textron Inc, has named **Richard L Eubanks** president. Randall is a producer of automotive trim, door frames, and body parts. Mr Eubanks has been serving as executive vice president of the company.

(Continued on p 162)



Chip – magnified 4 times – produced by machining Waspalloy with Rex 49

New Rex 49 outlasts other special purpose high speed steels better than 2 to 1

Rex 49 – a new high speed steel that can machine today's "difficult-to-cut" metals *faster and more economically* than existing special purpose high speed steels – is another in the long line of advances and improvements in specialty steels to come from Crucible research.

Crucible laboratory tests indicate that tools made of Rex 49 last as much as 4 times longer than other special purpose high speed steels . . . and it has a base price ½ to ⅓ of these steels.

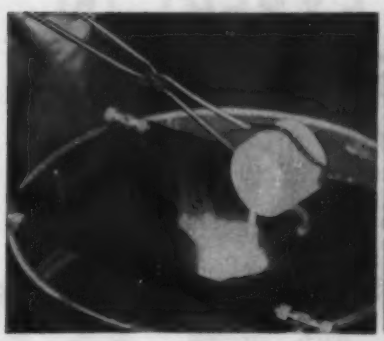
Both laboratory and field reports prove the advantages of Rex 49 for machining hard, tough or abrasive metals, such as heat-treated alloy steels, stainless, titanium, and superalloys. These tests also indicate that Rex 49 has advantages in machining the more conventional metals through increased speeds, feeds and depths of cut — and Rex 49 can be hardened with conventional high speed steel heat treating equipment.

Rex 49 is indicative of Crucible's continuing leadership in the development of improved high speed and tool steels.

For more information, write: *Crucible Steel Company of America, Dept. HD01, Four Gateway Center, P. O. Box 88, Pittsburgh 30, Pa.*

CRUCIBLE STEEL COMPANY OF AMERICA

CIRCLE 223 READER SERVICE CARD



Heat-Resistant Fiber From 3M Withstands Temperatures to 18,000 F Without Melting

Pluton, an all-organic, heat-resistant fiber, has been exposed in a plasma jet to temperatures of about 18,000 F without melting (see *AM/MM*—Mar 20, p4). The material, which will not conduct heat or electricity, retains its flexibility and part of its strength after exposure to intense heat.

In another test (see photos, above) a one-pound slug of molten steel, heated to 3000 F, was poured onto an unsupported one-lb-per-sq-yd sample of the fabric which was stretched across a frame. The molten steel solidified on the fabric without burning through it.

The fiber, which is available as a fabric, can also be worked into laminates reinforced with high-temperature phenolic resin to form structural parts or molding compounds. Entirely free of elemental carbon, Pluton does not char or melt.

In the form of a laminate (approximately a 50-50 combination with phenolic resin) the fiber is suitable for structural parts, like missile nose cones, which must withstand intense heat. It is being used in tests of rocket engine parts.

Minnesota Mining and Manufacturing Co, 900 Bush Ave, St Paul 6, Minn

MORE DATA? Circle 101, inside back cover

Iron and Zirconium With 2% Tin Now Come as Spherical Powders

Commercially pure ingot iron and zirconium with 2% tin are now available in the form of spherical powders, 20 to 150 microns in size. And, although not in stock, some platinum and 99.999% pure aluminum microsperes have also been processed.

In the microsphere process, 1/16-in. diameter wire is used as the starting material. It is processed in an inert atmosphere so that the starting alloy composition can be maintained in the final spheres of reactive metals.

Crystal Products Dept, Linde Co, 4120 Kennedy Ave, East Chicago, Ind

MORE DATA? Circle 102, inside back cover

Contact Cement Bonds Plastics, Metal Trim to Most Materials

A new general purpose industrial adhesive called Miracle CA-25 contact cement has been found successful for bonding plastic laminates to wood, metal, plastic, or glass surfaces. The material is claimed equally successful in bonding metal trim to wood, metal, or masonry surfaces.

CA-25 is described as a synthetic rubber base solvent-type adhesive of excellent tack, forming an immediate and permanent bond of excellent strength without the need of sustained pressure from clamps or presses.

The adhesive is easily applied with simple, readily available equipment; the adhesive strength is obtained without the use of heat; and the permanent bond improves with age, the company claims.

Supplied at a consistency suitable for brush, comb, or machine roller application, CA-25 gives coverage of about 150 sq ft a gal, and has shelf life of one year or more. It is waterproof, resistant to many acids, not attacked by vermin.

Miracle Adhesives Corp, Bellmore, LI, NY

MORE DATA? Circle 103, inside back cover

Three Carmet Cemented Tungsten Carbides Said To Increase Tool Life up to 200%

Three new grades of cemented tungsten carbides are said to combine shock resistance with long wearing ability and therefore make it easier for metalworking operators to pick the right cutting tool regardless of job.

The 700 Series—specifically CA-704, CA-711, and CA-720—is said to handle jobs ranging from fine finishing and precision boring to heavy and interrupted cutting because it combines edge wear and crater resistance with ability to endure both mechanical and thermal shock. The three grades feature:

- CA-704 has the hard, dense qualities needed to provide fine finish cuts and precision boring. It is also said to be good for medium-to-finish cuts in general purpose categories.
- CA-720 has the toughness and thermal shock-resistance for such jobs as medium and very heavy work, including interrupted cutting on the hardest steel alloys.

In field tests for a customer who was turning tapered, slotted, forged SAE 4140 valve plugs, an old type insert produced eight finished pieces; a CA-720 insert produced 25 finished pieces.

- CA-711 produced seven more rotor shafts from SAE 1035 than was possible with other carbide inserts, according to company test reports.

The new carbide grades are generally marketed for less than other premium grades now being produced, according to the manufacturer.

Carmet Div, Allegheny Ludlum Steel Corp, Oliver Bldg, Pittsburgh 22, Pa

MORE DATA? Circle 104, inside back cover

Atrax

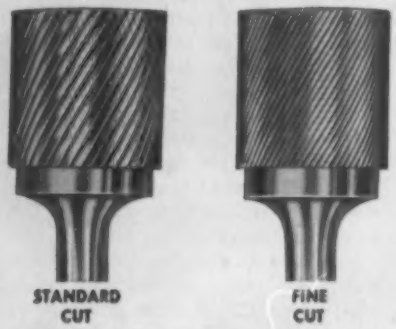
Precision Ground

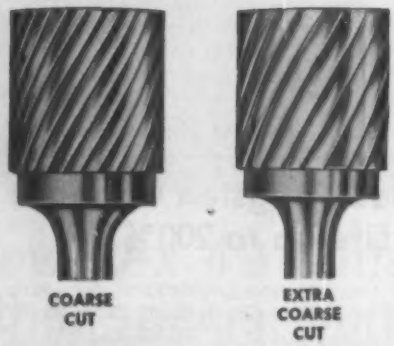
SOLID CARBIDE TOOLS AND BURS

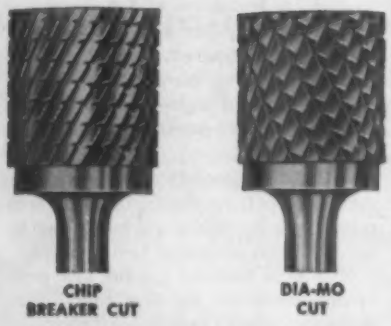
HOW TO BECOME AN EXPERT IN SOLID CARBIDE BUR SELECTION

Solid carbide burs are universal roughing and finishing tools. Atrax, manufacturing the most complete line, can furnish a size and shape to accomplish practically any metal removal or finishing operation.

SIX BASIC CUTS







Applying the Chip Breaker or Dia-Mo cut to the other types offers 11 different available cutting combinations for each size and shape of bur.

14 DIFFERENT SHAPES

To make burs one of the most versatile of metalworking tools, 15 standard shapes—181 different sizes, each in the 6 cuts, make available a total of 1086 different burs for a large variety of metalworking requirements.

PRODUCTION VERSATILITY

Atrax Burs, because of their controlled tool geometry and precision uniformity, are recommended for use on virtually all materials.

BUR SELECTION AND SPEEDS

Bur selection depends on the operation and material to be cut. Bur speed also depends on these factors and on diameter of bur used.

STANDARD BUR SETS

Atrax Solid Carbide Standard Bur Sets are also available through your dependable Atrax Distributor.

Complete engineering information on bur selection and use can be found on page 12 of the 148 page Atrax Catalog.

Be sure to send for your free copy today.

There is an Atrax Precision Ground Solid Carbide Tool engineered to every material and job application.

SEND FOR "STANDARD" REFERENCE ON SOLID CARBIDE TOOLS

THE ATRAX COMPANY

240 DAY STREET, NEWINGTON 11, CONNECTICUT

Rogers Introduces 3 Molding Compounds

Each of three new reinforced diallyl phthalate molding compounds conform with a government MIL specification. The three compounds are:

• RX 1260: A flame resistant, mineral filled diallyl phthalate free from magnetic particles. Conforming to MIL-M-14E, Type MDG, it offers outstanding electrical properties even after exposure to high humidity. Other features: dimensional stability, chemical resistance, and superior moldability particularly around metal inserts. No extender resins are used.

• RX 1280: Similar to RX 1260, this mineral-filled diallyl isophthalate molding compound is temperature resistant up to 500 F and conforms to MIL-M-14F, Type MDG. Low mold shrinkage permits mold interchangeability with other high temp molding compounds such as low-loss phenolics. It is not classified as flame resistant.

• RX 1380: A glass fiber reinforced material in the isophthalate group. Like RX 1280, it offers temp resistance up to 500 F. RX 1380 conforms to MIL-M-14F, Type SDG, and has excellent electrical properties in the presence of moisture, high strength, heat resistance and dimensional stability.

Rogers Corp, Rogers, Conn

MORE DATA? Circle 105, inside back cover

Internal Wrenching Bolts Designed For Temperatures to 1800 F

These bolts are stocked in most popular thread sizes and lengths made in high-temp material AMS 5735 with tensile strengths of 130,000 psi minimum. Heads are designed to accept standard Allen wrenches and can be supplied with drilled holes for lockwire installations when requested. These fasteners can also be supplied in such materials as 19-9DL, Inconel X, M-252, titanium, and other heat resistant materials.

Mercury Air Parts Co, 9310 W Jefferson Blvd, Culver City, Calif

MORE DATA? Circle 106, inside back cover

Fibreglass Vibration Pad Needs No Cementing Or Lagging

A specially processed vibration isolation pad of high-density fiberglass needs no lag screws or special foundations and is guaranteed not to "creep." The company claims use of this pad will result in savings up to 90% in machinery installation or relocation costs.

Because no cementing, weighting or lagging is necessary, the pad permits mobile, rather than permanent, installation of production machinery. The fiberglass construction of the pad is said to eliminate chatter in precision machines caused by externally-excited vibration.

The isolation pads are available in 18 x 18 x ½-in. sheets, prescored at 2-in. intervals for easy cutting-to-size at the job site.

Consolidated Kinetics Corp, 1065 Dublin Rd, Columbus 12, Ohio

MORE DATA? Circle 111, inside back cover

Stainless Socket Screw Has 125,000-psi Min Tensile Strength

Operating range of the KS 812 series is −300 to +800 F. Type 304 stainless provides excellent corrosion resistance and exceptionally low magnetic permeability of under 1.2. Room temperature ratings are 125,000 psi minimum tensile, 75,000 psi shear, and a tension-tension fatigue endurance limit of 40,000 psi. KS 812 meets or exceeds the requirements of specs AMS 7472 and FF-S-86. Screws are being made in No. 8 to ⅜-in. dia.

Standard Pressed Steel Co, Jenkintown, Pa

MORE DATA? Circle 107, inside back cover

Extra Large Rolled Plates Made Of High-Conductivity Alloys

Extra large rolled plates are produced in two resistance welding alloys, AMPCOLOY 95 and 97. They meet RWAA Classes II and III as well as other high conductivity applications.

The plates come in thicknesses of ⅜, ⅝, ⅞ and 1-⅛ in, and depending upon thickness, in max widths of 48 to 60 in., maximum lengths of 96 to 156 in. The stated thicknesses include 1/16 in. per side finish allowance.

Ampco Metal, Inc, Box 2004, 1745 S 38th St, Milwaukee, Wis

MORE DATA? Circle 108, inside back cover

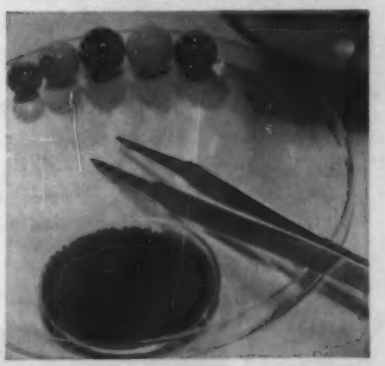
New Brazing Alloy Cuts Cost And Rejects Of Annealed Parts

A low cost, low heat phosphor-copper silver brazing alloy, Bright Finish No. 23, develops 50,000-psi tensile bonds with 25% elongation and has a working temperature of 1260 F. The alloy has been developed to cut down on rejects and reduce cost of thin parts annealed by high-temp silver brazing alloys.

Recommended for joining all copper alloys, the new alloy is said to be less expensive than high-analysis silver brazing alloys and yet maintain comparative strength, elongation and high corrosion resistance. It can be applied by all standard brazing methods, and is available in 1/16, 3/32, 1/8, 3/16, 1/4 x 18-in. rods and .050 x ⅛-in. strip.

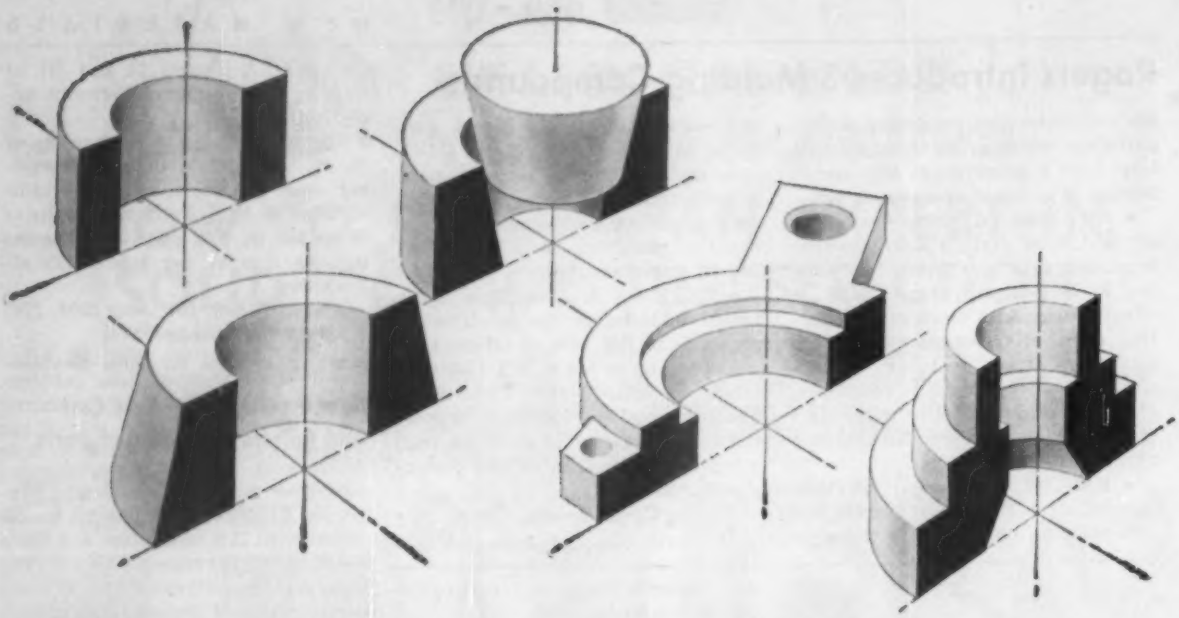
All-State Welding Alloys Co, Inc, White Plains, NY

MORE DATA? Circle 109, inside back cover



PRECISION BALLS OF SPECIAL materials are now available in both prototype and production quantities. Among the newer materials are: boron carbide, titanium diboride, glass-filled teflon, Indox I, irradiated polyethylene, ferrites, synthetic rubies and saphires, tantalum, titanium carbide, and high density aluminum oxides. Balls come in wide range of sizes, tolerances, and surface finishes — *Technical Services Dept, Industrial Tectonics, Inc, 3683 Jackson Rd, Ann Arbor, Mich* •

MORE DATA? Circle 110, inside back cover



when to consider Vertical Grinding

A simple test you can try for yourself quickly determines whether you should consider the Springfield principle of *vertical* grinding. Try it!

CHECK YOUR ANSWERS TO THIS QUIZ	YES	NO
1. Do you grind holes 4" in diameter and larger?	☐	☐
2. Do you grind taper holes or mating parts?	☐	☐
3. Do you grind on irregular shaped work?	☐	☐
4. Do you grind O.D. or I.D. shoulders, offsets, undercuts?	☐	☐
5. Do you grind pieces requiring extreme concentricity?	☐	☐
6. Do you require a 5 micro-inch or better finish?	☐	☐
7. Do some of your grinding jobs require many setups?	☐	☐

If you answer yes to three or more questions, a Springfield vertical universal grinder probably can save real time and money in your plant. Mail the coupon today for your free and informative copy of "Vertical Universal Grinders"; Bulletin 197-F.

THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO

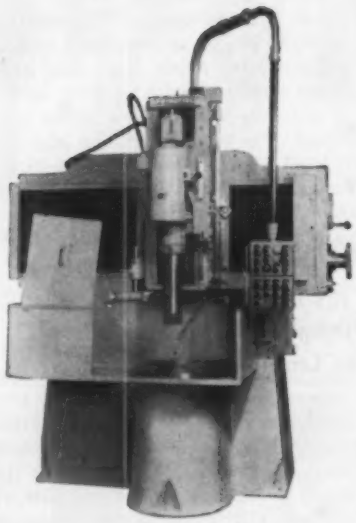
SPRINGFIELD

*name & title*_____

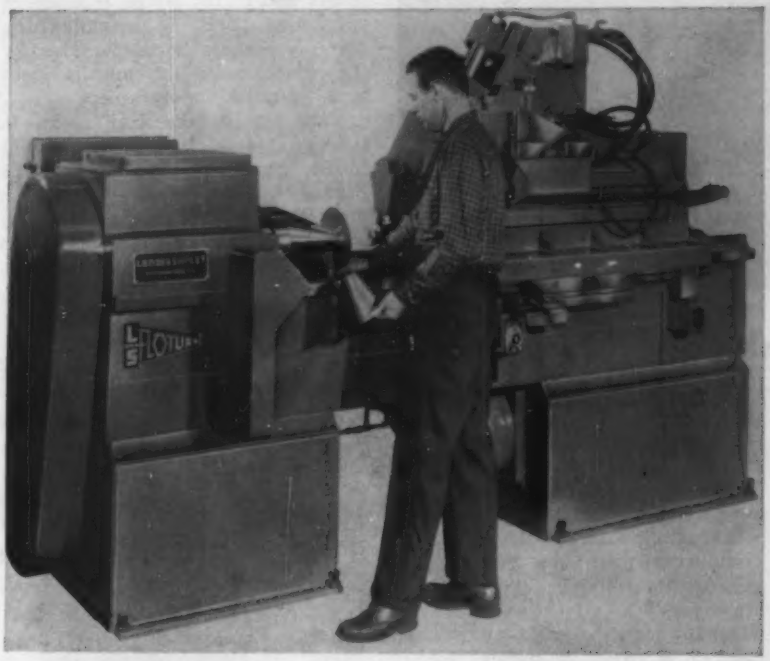
*company*_____

*address*_____

*city, zone, state*_____



Above is a standard Springfield 2A-TR vertical universal grinder. It swings 25"; the grinding head has a 21" stroke and it grinds holes to a nominal depth of 18". The head can be tilted 45° in either direction. Electro-hydraulic control is standard with pendant pushbuttons. The Model 2A-TR costs less than most horizontal chucking grinders of comparable size; it can do the same work plus a wide variety of jobs that just can't be done on a horizontal. Gravity works for you in vertical grinding.



Lodge & Shipley's Compact Floturn Made Specifically To Shear-Form Lighter Gages

Featuring all-hydraulic operation and automatic hydraulic tracer control of its single forming roller, the No. 12 Horizontal Floturn shear-forms light-gage metal parts ranging up to 12 in. in diameter and 15-in. long. The machine is only 10 ft long, 4 ft wide, and 6 ft high.

As examples of the type work that the compact machine is suited for, the manufacturer suggests utensils, light reflectors, cooking and scientific ware.

The machine—which is equipped with an 8-speed spindle drive from a 15-hp motor, or an optional variable speed drive—has among its features: a rugged headstock with precision oversize bearings and automatic lubrication, automatic cycle operation, yieldable tailstock, reversible roller head, 60° roller slide, adjustable feed cams, integral coolant system, and two separate hydraulic systems.

Operation of the machine is said to have been so simplified that a skilled operator is not required. The automatic production cycle under tracer control is easily adaptable to automatic loading and unloading of workpieces.

Floturn Div, The Lodge & Shipley Co, 3055 Colerain Ave, Cincinnati 25, Ohio

MORE DATA? Circle 51, inside back cover

Pocket-Size Dynamometer Said Easy To Install Without Tools

This dynamometer, which weighs only 2½ lb, is merely slipped onto a shaft and the collet tightened by hand. Interchangeable collets accurately fit a wide range of shaft sizes, and a self-contained V-belt pulley is adjustable from 2 to 3½ inches diameter. An adapter gives direct drive to hubs, spokes, and gears.

In operation, the dynamometer is viewed by a stroboscopic tachometer while rotating. Transmitted torque is read from the dynamometer dial, and rpm is read from the stroboscope dial. Horsepower may be calculated or read from chart.

Micro Pump Corp, Box 392, Danville, Calif

MORE DATA? Circle 52, inside back cover

Magnetic Tape Plotting System Checks Digital Data for N/C

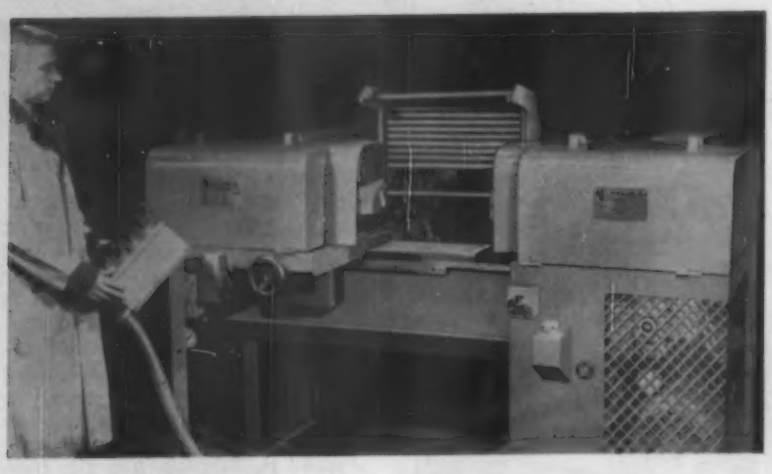
This new Model 570 magnetic tape plotting system makes an X-Y plot of digital data on a special recorder to check out magnetic tape for numerically controlled machine tools and other automation processes. Therefore, it catches costly errors in tape programming.

The equipment, which is compatible with most digital computers, has a completely digital operation which is said to eliminate analog conversions or servos and the problems of drift and dynamic response.

Operations are flexible in that plots may be superimposed on work done at a previous date; functions may be distinguished by color with a 15-sec change of recording pens; and functions may be plotted beginning at the end of a previous plotting.

California Computer Products, Inc, 8714 Oleta St, Downey, Calif

MORE DATA? Circle 53, inside back cover



Pines Double-End Finishing Machine Works Simultaneously on Both Ends of Tubing

The new Model 666 double-end machine with automatic feed simultaneously finishes both ends of tube, rod, or pipe in diameters from ½ to 3 in. Working to tolerances within 0.005-in. of length, the machine produces 2400 to 3000 finished ends (1200 to 1500 finished parts) an hour.

Workpieces are automatically fed into machining position by the hydraulically actuated Chute-Matic feed mechanism. Through the use of controlled hydraulic operation and positive depth-of-cut stroke, length tolerances are held within 0.005 in. on a production basis.

Five-foot workpieces are handled with the standard bed machine, up to 10-ft with an extended bed model. While minimum length is 5 in., adapters are available to accommodate work as short as 2½ in.

Typical operations include inside-outside deburring, chamfering and facing, and other light forming or pointing work such as chamfering screw machine stock. The Model 666 can be arranged for chamfering or pointing of solid stock in diameters as small as ¼ in.

Pines Engrg Co, Inc, 601 Walnut St, Aurora, Ill

MORE DATA? Circle 54, inside back cover

Bendix N/C Contouring System Now Uses Binary-Coded Decimal

The new DynaPath-20 contouring control system now accepts either binary-coded decimal or straight binary punched tape formats. The straight binary option has been provided to permit compatible programming with the previous systems.

The company points out that with the introduction of the BCD format, it is possible to make, modify, reproduce, and verify tapes on a Flexowriter; thus, control tapes for simple contouring operations can be prepared without the use of a computer. However, computer routines are available which output binary-coded decimal as well as straight, binary tapes for processing more complex parts.

The Bendix Corp, Industrial Controls Section 21820 Wyoming, Detroit 27, Mich

MORE DATA, Circle 53, inside back cover

HEXILINDER WHEEL, for use on 18-in. vertical spindle surface grinders, features hexagonal-shaped hole which acts as an agitator, keeping direct flow of water down inside the wheel in constant circulation. Wheel adapts to conventional mounting rings or to any cylinder wheel holder—*American Emery Wheel Works, 1 Richmond Square, Providence, RI*

MORE DATA? Circle 56, inside back cover

Floating Tool Holder for Screw Machines Have Only Nine Parts

A new (patented) floating tool holder, designed for use on single-spindle and multiple-spindle screw machines and turret lathes, is made of only nine parts. It is called the Aline-X because it compensates for the inaccuracies of misalignment from spindles to workpiece.

Made in shank sizes from ⅝ through 1½ in., the holder is said to fit any standard machine. The primary purpose of the tool—which also eliminates bellmouthing, oversizing, and scoring—is to provide a new measure of accuracy by compensating for misalignment on machines when they are used for precision reaming or boring.

Allied Metal Products, Inc, 1082 Farmington Ave, Kensington, Conn

MORE DATA? Circle 57, inside back cover

Lowcost Optical Comparator Provides 20X Magnification

Portable Micro Vu 300 provides 20X for visual inspection of details of componnets ranging in size from microminiature parts to 3-in.-AN fittings, contours of cutting or forming tools, and small assemblies. The model occupies less than 3 sq ft.

Features include achromatic color corrected lens; brilliant 8-in. screen to permit viewing under normal room lighting; a 2½ x 9-in. measuring stage with 3 x 3-in. vertical and horizontal travel; standard dial indicators. Price is $350.

Micro Vu, North Hollywood, Calif

MORE DATA, Circle 58, inside back cover

Special Mounting Equipment Aids Precision Measurement, Checking

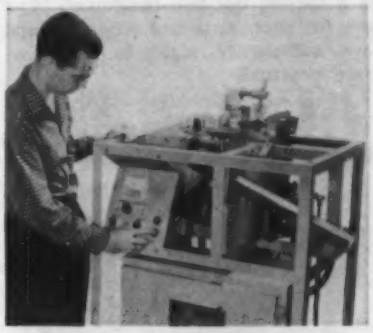
A wide variety of fixtures for mounting special equipment can now be provided on all the company's granite

surface plates. Included are threaded inserts, adapter holes, T-slots, and dove tail slots for holding work or attaching indexing heads, bench centers, and similar equipment.

Also available are precision graduated steel straight edges to aid in positioning and measurement of work. Fixtures can be located at any point on the surface plates as required.

The Herman Stone Co, 1860 N Gettysburg Ave, Dayton 27, Ohio

MORE DATA? Circle 59, inside back cover



Electronic Weight Comparator Works Automatically on Line

This fully automatic, production line electronic weight comparing system, named the Atronic Weight Comparator, automates the selection and screening of parts and materials by weight comparison. When used in a processing or production operation, it handles a continuously moving stream of parts or materials, rapidly weighs each item individually, automatically compares this weight to within one gram of a predetermined proper weight, and either accepts or rejects the item.

The system, which handles items weighing up to five pounds, is supposedly designed to operate in factory environments subject to severe vibration and shock.

Atronic Products, Inc, West Conshohocken, Pa

MORE DATA? Circle 60, inside back cover

Optical Comparator Screen Can Be Cleaned Without Weakening Lines

A G Life Line optical comparator screens can be cleaned hundreds of times with no weakening of lines, according to the manufacutrer. Because they contain an efficient light-diffusing material, the screens are said to have photographic accuracy with great visual contrast, maximum light diffusion, and a minimum of surface reflection.

Coating charts with lacquer or smearing with oil does not affect light diffusion, and there are no screen hot spots. Old worn charts may be accurately reproduced on the screens.

Automation Gages, 100 Seneca Ave, Rochester 21, NY

MORE DATA? Circle 61, inside back cover

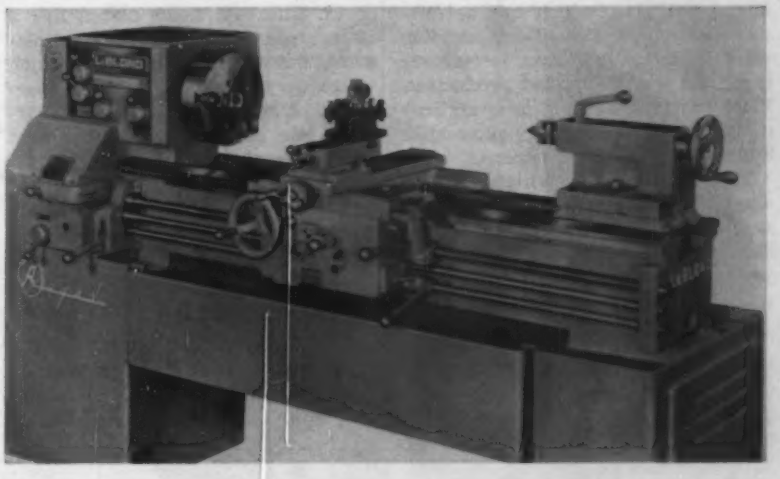
Tracer System Automates Milling Of Reliefs on Extrusion Dies

Utilizing a standard milling head and a two-dimensional tracer control system, this unit permits constant feed rate control and provides a fast, simple method of reproducing intricate designs for extrusion dies. The system can also be applied in some cases to milling the actual die opening. In this instance, end mills as small as 0.039 in. are used as the cutting tool.

Geometry of the sensing stylus and its extremely small diameter (0.025 in.) enable the system to follow extremely small designs. Tracing speed can be controlled over a 50:1 speed range. A typical range would be from 1 ipm to 0.020 ipm. The system will produce consistent accuracies of ±0.003 in. It is electromechanically controlled, operating from a templet, and will follow any contour around a 360° path at a constant cutting speed, regardless of direction. The value of cutting speed can 1) be varied manually or 2) automatically controlled as a function of spindle speed to maintain a constant feed rate in inches per revolution of the spindle.

Seneca Falls Machine Co, Fyfe Bldg, Seneca Falls, NY

MORE DATA? Circle 62, inside back cover



LeBlond Redesigns Line of Regal Lathes

The entire line of Regal lathes has been redesigned. The line includes 13, 15, 17, 19, 21, and 24-in. models. In addition, there are 17 and 19-in. plain bed gap, and 17/28-in. and 19/28-in. sliding bed gap models. The 15-in. model above shows the new look of the line.

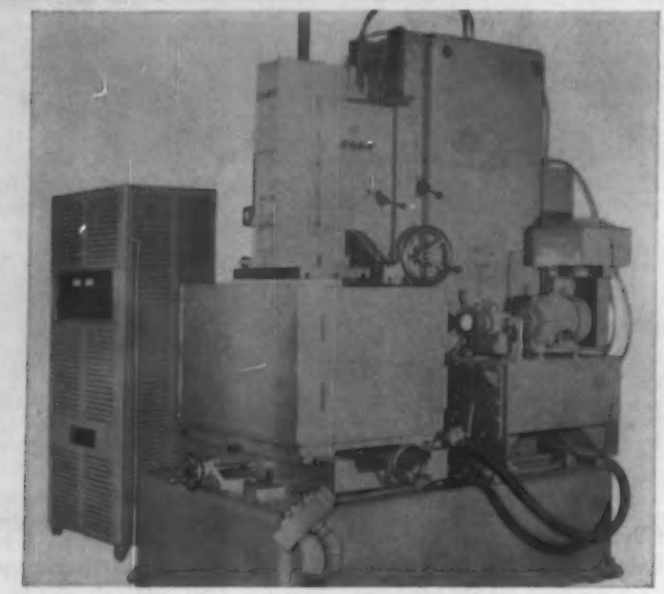
New design features are particularly apparent in the headstocks, which have all undergone a transformation in controls to combine ease of operation with efficiency. The Regals are said to have many heavy-duty lathe features not ordinarily found in low-cost lathes.

Among these features are heavy three-bearing spindles, automatically lubricated and totally enclosed quick change boxes, motor enclosed in head leg, and compensating V-ways to give accurate carriage guidance and distribute cutting forces in the bed.

A complete line of accessories includes Regal Trace, which works from low-cost flat templets. Also, the 13 and 15-in. models are available with cabinet bases for storage.

R K LeBlond Machine Tool Co, Madison and Edwards Rds, Cincinnati 8, Ohio

MORE DATA? Circle 63, inside back cover



Elox Electrical Discharge Machine Tool Claimed World's Largest Production Type

Model HRP-110, which has a transistorized power supply and handles work loads up to 2 tons, is claimed to be the world's largest production EDM machine tool. It is a vertical ram type tool with a fully automated hydraulic servo-feed system.

The machine — which comes equipped with pumps, table, filter system, and holddown jackscrews— has a movable cross table which adjusts 12 in. left to right, 6 in. front to back, and takes dies up to 42 x 36 in. The ram head platen has a 12-in. stroke, a 20-in. vertical adjustment, and will take electrodes which weigh up to 2,000 lb. However, precision of movement is said to guarantee die clearance and alignment accuracies of 0.0001 in.

The transistorized power supply delivers up to 300 amp; electrode end wear ratios are as high as 50 to 1.

Elox Corp of Michigan, 1830 Stepheson Hwy, Troy, Mich

MORE DATA? Circle 64, inside back cover

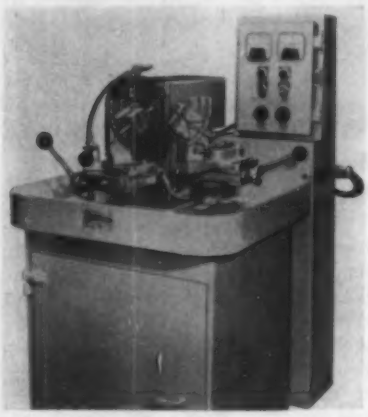
Peninsular Grinding Wheels Said To Give 25 to 50% Longer Life

Two new types of K-1017 cutoff wheels, in both regular and reinforced styles, are reported to have shown, in tests, an average of 25 to 50% higher wheel life than cutoff wheels now in use. The reinforced wheels are available for production testing only in 12 sizes of 24-grit and the non-reinforced wheels in 10 sizes and several grits.

The reinforced types are designed for deep cuts or where side pressure is a factor; the non-reinforced type are for short cuts and where setups are sufficiently rigid to minimize side pressure.

Peninsular Grinding Wheel Co, 729 Meldrum Ave, Detroit 7, Mich

MORE DATA? Circle 67, inside back cover



Ampak Electrolytic Sharpener Claimed 3 to 7 Times Faster

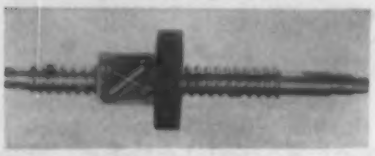
The Ampak electrolytic drill sharpener for high speed steel twist drills, is claimed to speed the sharpening rate 3 to 7 times over that of conventional grinding, but not to generate the heat that conventional methods do. A greater degree of control of drill point geometry is possible through a simple setup of drill holding fixtures that can be made in seconds.

The sharpener allows all drill point angles from 90 to 180°; lip relief angles from 0 to 20°; and helix angles from 30° positive to 30° negative.

The grinder has a 1 hp motorized 300 amp electrolytic spindle, complete self-contained 8 v, 300 amp dc power supply, constant electronic voltage regulator, automatic visual overload warning system, and self-contained electrolytic fluid systems.

Connecticut Special Machine, Inc, Bridge St, Winsted, Conn

MORE DATA? Circle 68, inside back cover



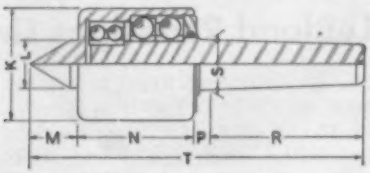
Ball Bearing Screw Line Limits Travel But Still Allows Rotation

This new line of ball bearing screws allows limiting the travel of the nut at predetermined positions with continuing rotation of the screw. Freewheeling action is possible because of a stop in the screw at each end of desired nut travel, and a simple freewheeling device. There is no need for limit switches.

The load-carrying capacities of the units are the same as conventional screws of the same size. One, with a ball circle diameter (pitch dia) of 0.631 in. was tested for 45,000 cycles with a 500 lb load.

Saginaw Steering Gear Div, General Motors Corp, Saginaw, Mich

MORE DATA? Circle 65, inside back cover



NEW MODEL LIVE CENTER has double thrust capacity because it has a flush-ground tandem ball bearing; a double row of radial bearings is also included. Points are made of chrome nickel alloy steel, hardened and ground true with bearings. Standard sizes are No. 3 to 6, taper inclusive— *Sturdimatic Tool Co, 2900 F St, Detroit 16, Mich*

MORE DATA? Circle 66, inside back cover

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Product Mfgd: _____ Approx. No. Emplys at Plant: _____

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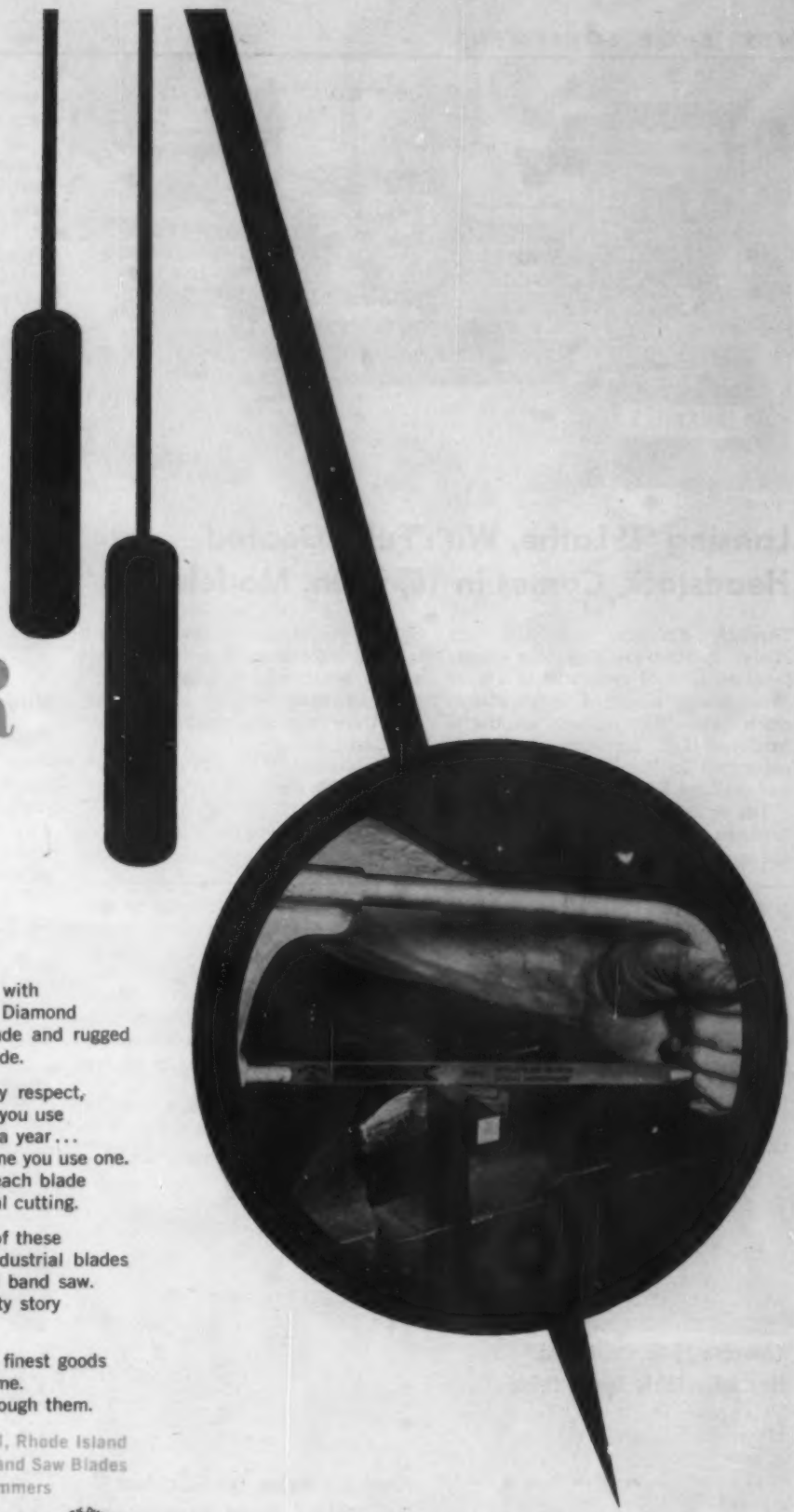

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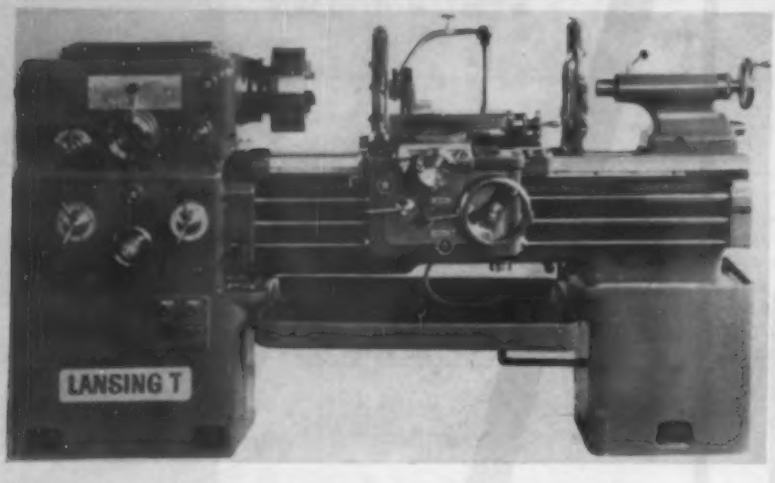


Lansing 'T' Lathe, With Fully Geared Headstock, Comes in 16, 18-in. Models

Through dial-type controls, this Model T lathe gives spindle speeds from 46 to 2000 rpm with a 7½ or 10-hp motor mounted in the headstock base. The camlock spindle is hardened and precision ground, is supported in Timken bearings, and has oversize bores of 2⅛ and 3 in.

The fully geared headstock, which features an improved disk clutch to the spindle drive, has hardened precision ground gears and a built-in lubrication pump. A quick change sealed gearbox with its own lube pump and dial feed gives longitudinal and transverse feeds separate from threading feeds.

The tailstock is heavily constructed with a calibrated dial for quill movement.

S & S Machinery Co, Brooklyn, NY

MORE DATA? Circle 69, inside back cover

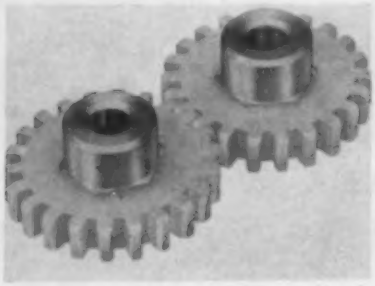
Clausing 15-in. Drillpress Has Adjustable Speed Drive

This new 15-in. drillpress, which comes in bench and floor models, is a heavy-duty, general purpose drill that comes with choice of positive power adjustable speed drive with a range of 500 to 4500 rpm, or with a five-speed drive with spindle speeds from 410 to 5380 rpm. It has a 3-in. dia column.

Other specifications: drill to center of 15-in. circle; 4¾-in. spindle travel; floor models have 41¾-in. spindle-to-table capacity, 47⅛-in. spindle-to-base; bench model capacities are 14¼in. over table, 19⅝-in. over base; choice of No. 2 MT spindle or ½-in. key chuck; ½ or ¾ hp motor. Prices start at $131.

Clausing Div Atlas Press Co, 2302 N Pitcher St, Kalamazoo, Mich

MORE DATA? Circle 70, inside back cover



Precision Nylon Cut-Gear Line Has Molded Metal Insert Hubs

The Nymet line of precision nylon cut gears, with molded metal insert hubs, has cut tooth gears up to 3-in. OD with up to a ½-in. face in any quantity without tool charge. The gears are available in 48, 32, 24, 20, 16, 12 pitch, and in 14½ and 20° pressure angles.

Strength factor of the Nymet gears is said to be the same as that for metal gears (using the Lewis formula); this assumes that the entire load is born by a single tooth. The resiliency of the nylon distributes any overload over more than one tooth, thereby minimizing wear and failure.

The Climax Metal Products Co, 863 E 140th St, Cleveland 10, Ohio

MORE DATA? Circle 71, inside back cover

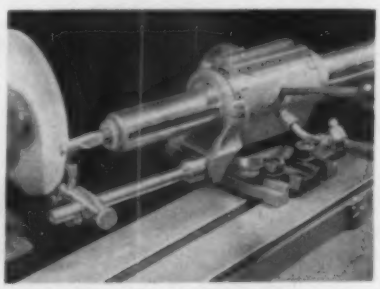
Wire Straightener and Cutoff Machine Needs No Maintenance

Model WC-20 wire straightener and cutoff machine, which is said to operate without maintenance, handles wire from 1/32 to ¼-in. dia, and in lengths of ¼ in. to 12 ft. It operates at four speeds from 85 to 175 fpm.

The machine, said to be economical to operate because of its air cutoff system, is priced at $4500 fob; delivery time is 90 days, at present.

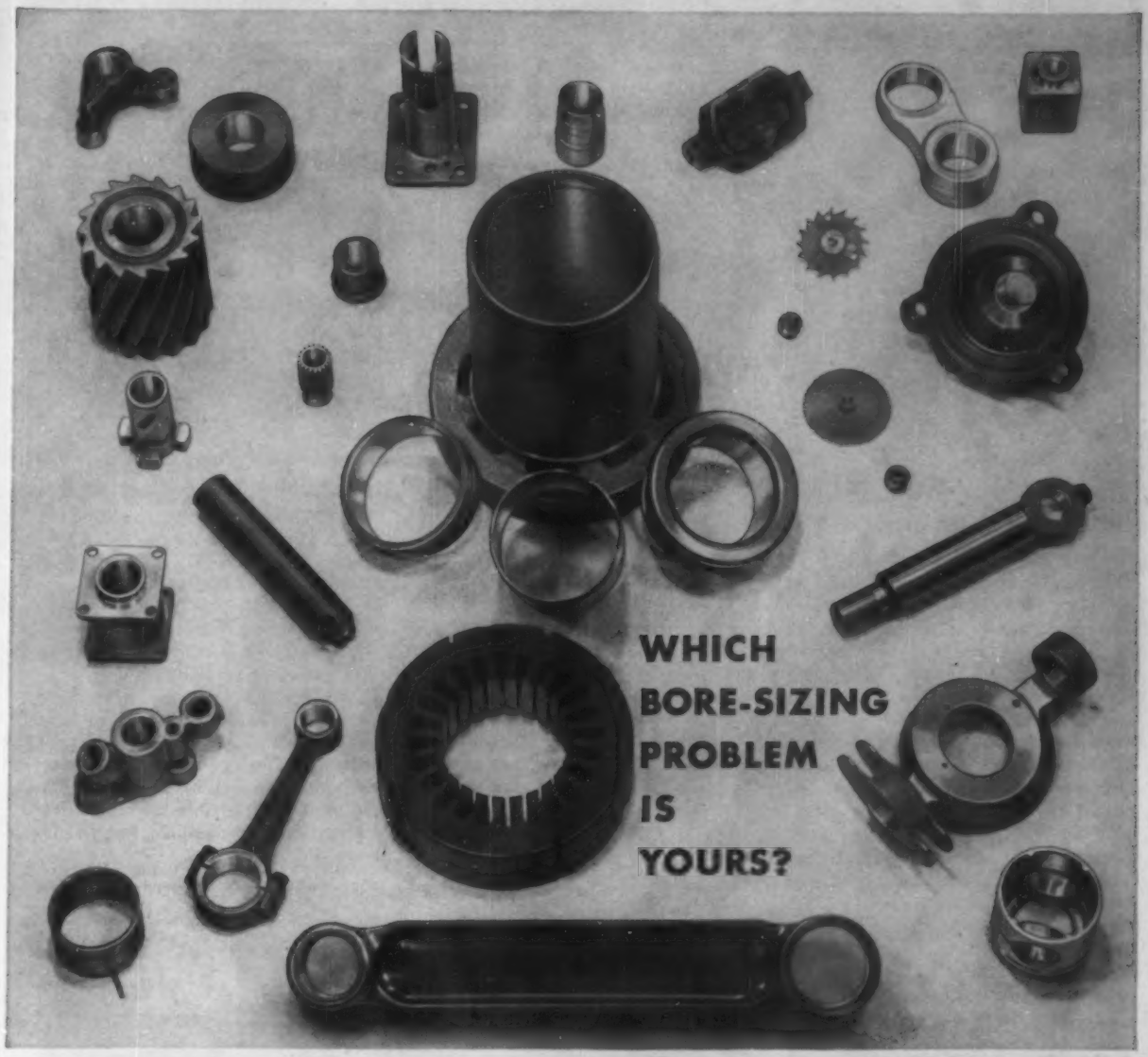
W V Industries Div, Vemaline Products Co, Franklin Lakes, NJ

MORE DATA? Circle 72, inside back cover



MILLING CUTTER SHARPENING FIXTURE has a spindle that floats on a 0.00015-in. cushion of air. The flow of air inhibits entrance of grinding dust and makes easy the delicate sharpening of tiny tools as small as 1/32 in. up to 1¼-in. shank capacity. Cutter sharpening range is through 6 in. dia —*Harig Mfg Corp, 5757 W Howard St, Chicago 31, Ill*

MORE DATA? Circle 73, inside back cover



A Sunnen Honing Machine will handle any hole-sizing job shown here. It's the most versatile machine for all types of I. D. work . . . now used in thousands of shops.

It corrects all previous machining errors with minimum stock removal . . . and guarantees tolerances to .0001" with any desired surface finish.

You pay no premium for the extra precision . . . because Sunnen Honing is a fast, economical abrasive stock removal process.

It handles tandem bores, thin wall parts, blind holes, bores with ports or lands—in any size or shape part. No fixtures, no chucking or set up time.

I. D. range: .100"—2.625" with standard tooling. Built to order thru 4½".

SOLVE ALL OF THEM WITH . . .

SUNNEN HONING

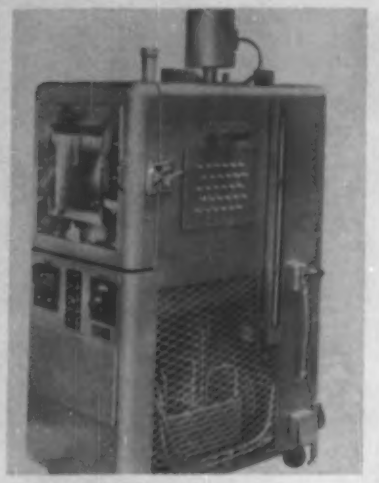
SUNNEN PRODUCTS COMPANY

7920 Manchester Ave. • St. Louis 17, Mo. • Canadian Factory: Chatham, Ontario

ASK FOR FREE BOOKLET

X-SP-5075 . . . showing 99 honing case histories covering all types of bore-sizing problems.

TODAY'S TOLERANCES AND FINISHES CALL FOR HONING



Cincinnati Sub-Zero Chamber Gives Temp from —100 to 500 F

This three-cubic-foot environmental chamber controls temperatures from —100 to +500 F accurate to ±2 F; it provides a thermal capacity of 1200 BTU/hr at —100 F. From ambient, it pulls down to —100 F or warms up to 500 F in one hr.

This model HASU-100-3-HC has a 18 x 18 x 18-in. unobstructed chamber area equipped with a recessed fin coil evaporator, adjustable shelves, pressurized amphenol fittings, and interior illumination. The door has a 12 x 12-in. frost free multipane window especially designed to withstand thermal shock and altitude testing.

Cincinnati Sub Zero Products, 3922 Reading Rd, Cincinnati 29, Ohio

MORE DATA? Circle 74, inside back cover

Self-Locking Insert Eliminates Seizure and Galling to 1200 F

A new self-locking insert developed specifically for high temperature fastening applications up to 1200 F is made of Inconel X wire, precision-formed to a diamond shape and coiled to provide the thread. The Screw-Lock insert attains its locking effect from a grip coil midway in its length. This coil is polygonal in shape rather than circular like the rest of the threads.

As the bolt is screwed through the threads of the insert, it forces the flat chords of the grip coil to conform to the usual thread shape, while the chords maintain a uniform locking effect on the bolt, even after repeated assembly and disassembly. This is said to eliminate the need for lock-nuts, lock-washers, and lock-wiring.

A full range of UNF sizes from 10-32 through ½-in.-20 is available, with immediate delivery in the ¼-28 series in 1½ and 2 dia lengths.

Heli-Coil Corp, Danbury, Conn

MORE DATA? Circle 75, inside back cover

Automatic Saw Sharpener Cuts Teeth at 50-80 per min

The Buchador saw sharpener is capable of grinding circular metal cutting saw blades, cutting new teeth in disks, and adapts to sharpening power hacksaws, bandsaws, and straight-edge knives. Capacity for metal cutting circular saws is 2 to 16 in.; for wood and plastic cutting circular saws, 2 to 24 in.

Dist by Cosmic Inc, 1028 Connecticut Ave, Washington 6, DC

MORE DATA? Circle 76, inside back cover

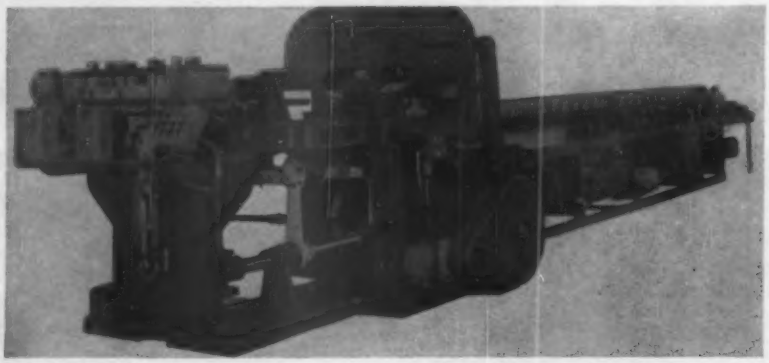
Micro Coolant Pump Adapts to Any Machine Tool Coolant Need

This electric-motor-driven impeller type pump, built so that it will operate efficiently partially or completely submerged, is said to be easily adapted to any machine where coolant may be desired. The unit pumps to within ⅛-in. of bottom, operating on a minimum amount of coolant.

The standard Model 301 is complete with a 4-ft, 115 v, 1-phase, 3-wire conductor which is water and acid resistant. The coolant hose is four feet long with a cutoff valve and one foot of sta-put flexible tubing.

Micro Development Co, Inc, Brentwood, Md

MORE DATA? Circle 77, inside back cover



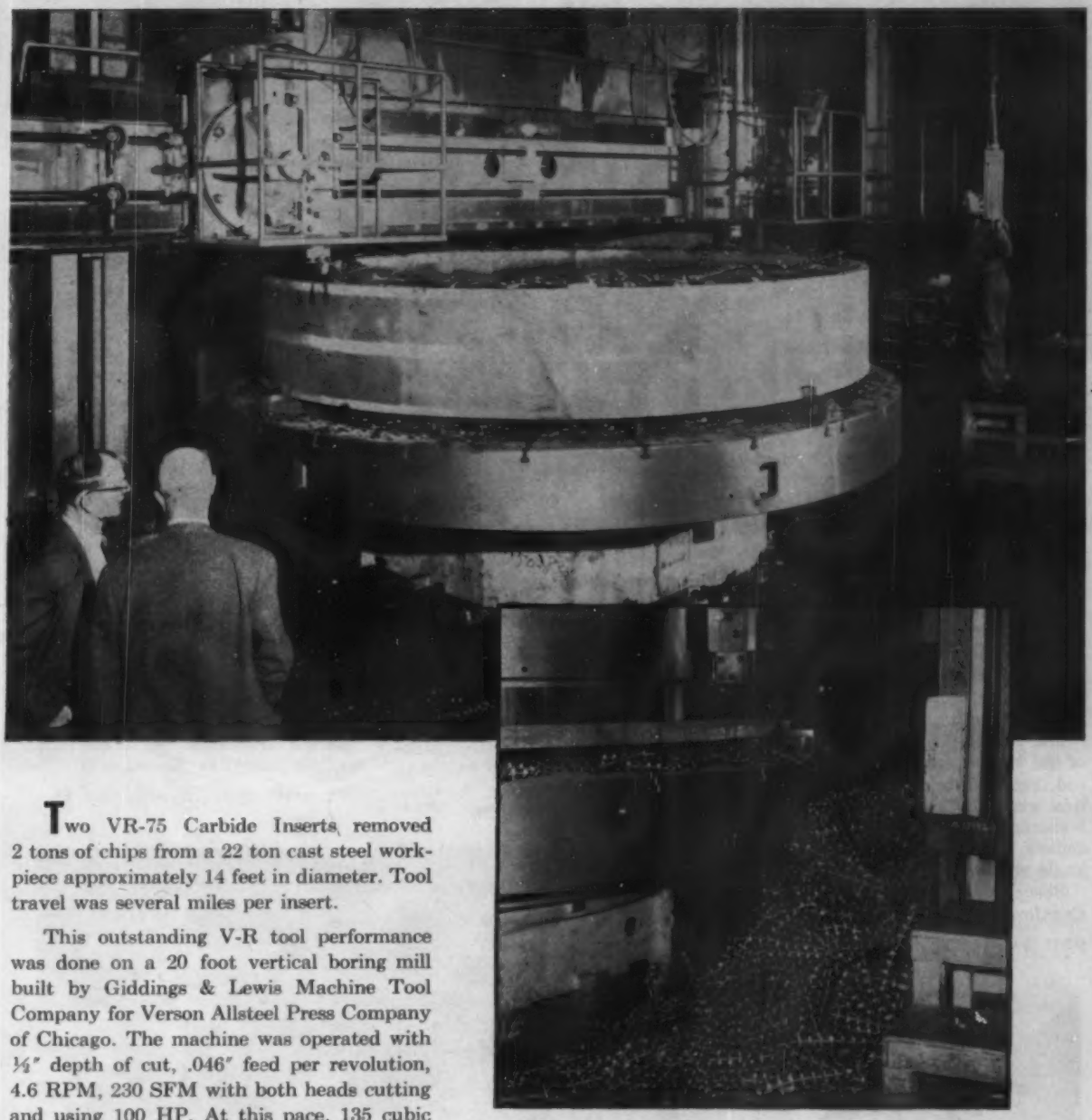
Bliss Bodymaking Machine Has 50% Faster Output of Rectangular Cans at 60 a Min

Model No. 014 bodymaking machine, which makes up to sixty 2 or 2½-gal rectangular cans per min, is said to operate 50 to 60% faster than possible with any previous machine. Several important new design features have made these higher speeds possible.

The machine features improved gaging, an overhead clamp which positions and holds the body blank at the forming station, and an extremely smooth overhead cam drive for the forming after they have been gaged by adjustable front stops. Cam-operated body blank supports are also included.

E W Bliss Co, 1375 Raff Rd, Canton 10, Ohio

MORE DATA? Circle 78, inside back cover



Two VR-75 Carbide Inserts removed 2 tons of chips from a 22 ton cast steel workpiece approximately 14 feet in diameter. Tool travel was several miles per insert.

This outstanding V-R tool performance was done on a 20 foot vertical boring mill built by Giddings & Lewis Machine Tool Company for Verson Allsteel Press Company of Chicago. The machine was operated with ½" depth of cut, .046" feed per revolution, 4.6 RPM, 230 SFM with both heads cutting and using 100 HP. At this pace, 135 cubic inches of metal were removed per minute. A finishing cut followed using 8 RPM, 360 SFM with .023" feed per revolution.

Such successful case histories are not unusual at Vascoloy-Ramet. V-R's exceptional carbide quality will give you the same outstanding service. Call your V-R man in today, or write for a fully illustrated catalog.

4,000 pounds of chips removed with only two VR-75 Carbide Inserts

CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

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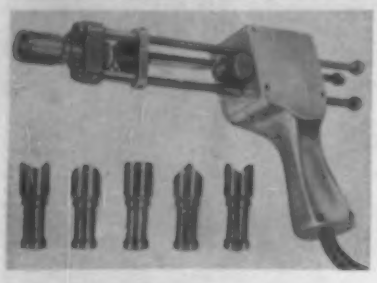


Beeco Electric Arc Gun Said to Perform Six Different Functions

When connected to any ac or dc welding machine power supply, this "Six Shooter" is said to serve as a spot welder, stud welder, tack welder, button welder, hole burner, and riveter. It will burn a hole in two or more pieces of metal of any gage with a sum thickness of up to ¼ in. on a single downward thrust of the gun. As hand pressure is released gradually and the spring-return mechanism moves the gun up, the rod melts, filling the hole.

Complete arc penetration may produce a hole, or a rivet, as desired; a partial arc penetration may produce a stud, spot, tack, or button.

The gun costs $59 including choice of one nozzle, one pound of welding rod, and a fully illustrated instruction manual. Complete with set of 5 standard nozzles (of flat, concave, convex, inside angle, and outside angle shape), the price is $99.

Beeco Mfg Corp, P O Box 116, Cranford, NJ

MORE DATA? Circle 79, inside back cover

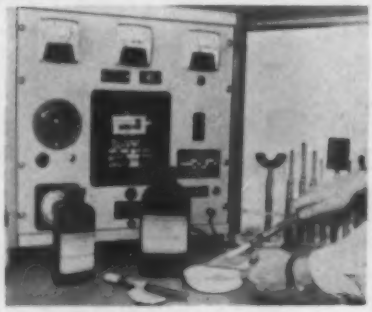
Quick-Chucking Device Said To Sharpen Drills in Seconds

The Port-A-Point drill grinder, which chucks quickly onto any small portable electric drill, is equipped with a steel or carbide grinding wheel designed with a flip-flop drill holding device that is said to sharpen drills accurately in a matter of seconds.

No table or bench setup is needed to use the sharpener which is held manually during the operation while attached to the electric drill from which operating power is received. It re-points masonry and steel twist drills up to ½ in. diameter.

SWG Corp, 903 Wrightwood Ave, Chicago 14, Ill

MORE DATA? Circle 80, inside back cover



Equipment Gives Selective Plating on Almost Any Base

Using this special power pack, plating styluses, and non-toxic, generally basic electrolytes, this new process permits the deposit of many metals and alloys on almost any conductive base material. Thicknesses are precisely controllable, and are easily limited only to those areas where the plate is actually needed.

Totalizing ampere-hour meter on power pack tells when exact desired plating thickness has been achieved. Solution come in quart or pint bottles, and a wide selection of tools is available. Delivery time is two to three weeks.

Selectrons, Ltd, 520 Fifth Ave, New York 36, NY

MORE DATA? Circle 81, inside back cover

Heavy-Duty Hydraulic Saw Cuts Material up to 24 x 24 in.

Model 2424, largest in Racine's metal saw line, will cut material up to 2 x 2 ft in size or with 25-in. dia, employing a 36 x 4½ in. x 0.125 x 2T saw blade to obtain maximum capacity. A 10-hp 4-speed Lima motor and a built-in three-speed gear box provide 11 variables in speed ranging from 12 to 145 spm. Stroke length is 6 in.

A major feature of the machine is the adjustable pressure hydraulic feed with a range of 0 to 350 psi. Total downward pressure of approximately 4200 psi can be applied with the double main cylinders.

Racine Hydraulics & Machinery Inc, 2000 Albert St, Racine, Wis

MORE DATA? Circle 82, inside back cover

New Press Eliminates Welding, Finishing

Capable of cold steel impacting, this hydraulic press mass produces missile motor tubes without welding or finish machining. The press will extrude either open or closed-end tubes up to 14 in. dia and 10 ft long.

Inside and outside wall tolerances can be held to 0.005 in., and extrusion can be performed on tubes having internal and external wall surfaces of varying thickness. The press also allows the design and extrusion of tubes with many types of vanes, bosses, lugs, ribs, flutes and other projections as integral parts.

The company expects its new press to have many industrial applications in addition to producing precision products for space programs.

The Matthews Corp, 12923 S Cerise St, Hawhorne, Calif

MORE DATA? Circle 83, inside back cover

WALKER-TURNER 17" DRILL PRESSES

EVERYTHING NEW

but the price!

Because the entire line of W-T "Light-Heavyweight" 17" Drill Presses has been completely redesigned, it now gives you new flexibility, new accuracy and new convenience. You'll like the increased operating economy you get, but even more, you'll like the price tag. All 44 hand feed models of the "New 17" are being introduced at no increase in cost! And for semi or fully automated drilling jobs, you can add new Rockwell Power Feed. This low cost accessory is available on every model.

Only *you* can rate the value to your job of pace-setting features such as New Concept Depth Stop, New "Swing Away" Guard and New "Pivoting" Motor Mount. To see this machine in action visit your Walker-Turner Distributor (listed under TOOLS or MACHINE TOOLS in the Yellow Pages). Learn for yourself why more people in metalworking call Walker-Turner the *value* line.

FREE BROCHURE pictures and describes the complete line of W-T 17" Drill Presses. Write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WD-21, 400 N. Lexington Ave., Pittsburgh 8, Pa.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

CIRCLE 229 READER SERVICE CARD

Bostik Adhesive Applicator Has Pushbutton Control

Model B has a pushbutton control on the brush barrel for exact regulation of adhesive flow. The applicator feeds solvent and water-based adhesives through a flexible hose directly into the brush under ordinary factory air pressure. It includes a pressure tank which dispenses adhesives of average viscosity at 20-lb pressure and has an air regulator that allows accurate setting at any desired pressure. Tanks of 2 and 5-gal capacity are available.

Bostik Adhesives, B B Chemical Co, 784 Memorial Drive, Cambridge 39, Mass

MORE DATA? Circle 84, inside back cover

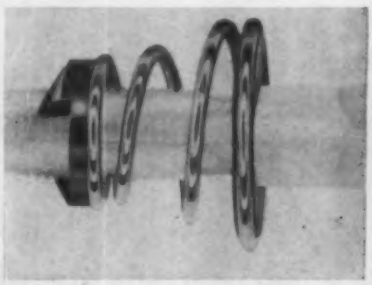
Resin Dispensing Machine Produces Extra Small Volume Shot

Metering, mixing, and dispensing small quantities of two-component resin systems over a wide range of materials and operating conditions is possible with the Micro-Shot machine, an electro-pneumatic device. Designed to produce a shot volume from a fraction of a cubic centimeter to 20 cc, the machine is particularly applicable for adhesive and casting jobs.

Unit can be operated automatically, can handle both filled and unfilled systems, and offers temperature control features on either resin or activator systems or both.

Automatic Process Controls Inc, 1170 Morris Ave, Union NJ

MORE DATA? Circvle 85, inside back cover



Deburring Tool Allows Tapping And Deburring in One Operation

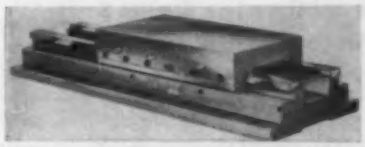
This new deburring tool, which makes it possible to tap and deburr pipe threads in a single operation, is designed to fit all makes of pipe taps in sizes from ⅛ to 1 in. Operating

like the standard Burr-Bit, the pipe tap Burr-Bit is easily slipped on the pipe tap itself in a matter of seconds.

The tool combines tapping and deburring in a single operation because it removes the burr as the tap is being withdrawn from the threaded hole. Made of high speed steel, the tools are available for both straight and tapered holes.

Vernon Devices Inc, 481 E 3rd St, Mt Vernon, NY

MORE DATA? Circle 86, inside back cover



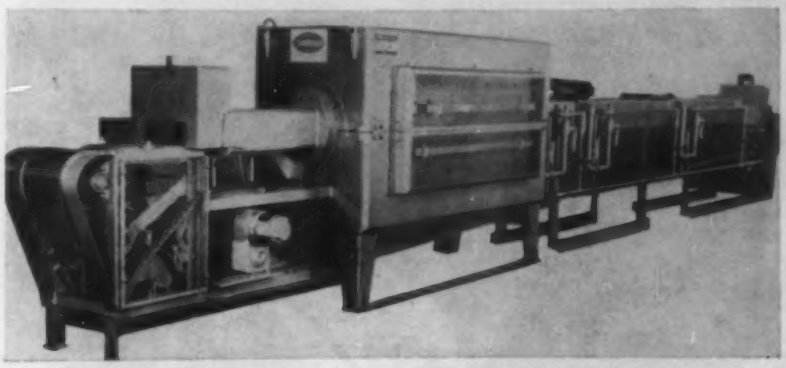
Gilman Slide Assemblies Offered in 33 Standard Sizes

New slide assemblies with hardened steel ways are designed for heavier loads and longer maximum stroke lengths than Gilman dovetail slides. They are available in a broad range of standard saddle and base sizes which can be specified to fit the job.

Saddles come in widths of 9, 11, and 15 in. In each saddle width series, a selection of four saddle lengths and three base lengths is offered. The base length should always be at least two-thirds of the saddle length. Standard saddle working surfaces range from 9 x 9 in. to 15 x 60 in. Maximum stroke lengths up to 45 in. are available. Optional built-in auxiliary equipment includes power cylinder (air or hydraulic); leadscrew (Acme-type or ball bearing screw); electric cycle controls; 1-shot lubrication system; composition way wipers; accordion way covers.

Russell T Gilman Inc, 623 Beech St, Grafton, Wis

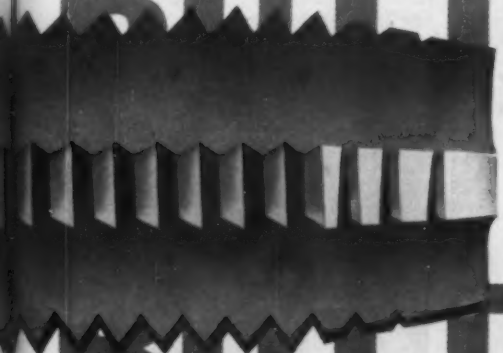
MORE DATA? Circle 87, inside back cover



ELECTRICALLY HEATED CONVEYOR MUFFLE FURNACE does atmosphere controlled continuous copper brazing, annealing, or bright hardening of stainless parts. Built in five sizes with heating chamber dimensions ranging from 4 x 2 x 36 to 12 x 4 x 72 in., it produces from 30 to 180 lb an hr. Max temperature is 2100 F—*Sunbeam Equipment Corp, Meadville, Pa*

MORE DATA? Circle 88, inside back cover

BUTTERFIELD
BUTTERFIELD



Like all tools in the complete Butterfield line, Butterfield taps are noted for precision performance, long life, and high value as production tools — not only when used individually but with other taps or cutting tools. Get these production benefits . . . through prompt deliveries and trained technical service in your machining operations . . . Call your Butterfield Distributor. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

BUTTERFIELD
BUTTERFIELD

Division, Union Twist Drill Company, Derby Line, Vt.

More Pieces COMPLETELY
finished in less time on
GOSS & DE LEEUW AUTOMATIC CHUCKERS

This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & DeLeeuw feature provides for finishing machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

●

Send for illustrated literature which fully describes this recent Goss & DeLeeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Skil Offers Two Recipro Saws To Cut Virtually Any Material

Model 701 has two speeds, 1000 and 1400 spm, for cutting different gages and densities of metal. The low speed is for stainless steel, other hard alloys, cast iron, any hard abrasive material. Tested on 1-in. steel bar stock at 1000 spm, it makes a clean, burr-free cut in 23 seconds. The high speed is recommended for cutting mild steel and non-ferrous metals.

Model 700, reported to be the first 2-speed reciprocating saw, has been improved to include new features. Its two speeds are 3500 spm for cutting wood, composition, and plastic, and 2600 spm for many metal cutting jobs. Length of blade stroke has increased more than ¼ in. to 13/16 in., providing better chip clearance in thick material.

Standard equipment for both models includes four assorted blades, blade clamp key and holder, and an all-steel carrying case. Model 700 is priced at $99.50, Model 701 at $124.50.

Skil Corp, 5033 Elston Ave, Chicago 30, Ill

MORE DATA? Circle 89, inside back cover

Portable Squirt Machine Delivers Oil to Tool Edges

Adaptable to a variety of machines that are not equipped with a coolant device or oiling arrangement, the Squirt's doubling-acting oil pump delivers two squirts of oil at one

touch of a button and directs the oil to dies on pipe threading jobs. Capacity is 2/3 qt. It is available with one or two pumps and with 12 or 18-in. flexible metal hoses. Weight is 9 lb and it is equipped with a carrying handle.

M-M-A Inc, Lancaster, Pa

MORE DATA? Circle 90, inside back cover

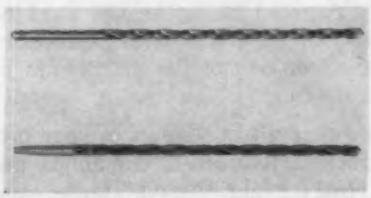
Hand Operated Ram Bender Bends up to 2-in. Pipe

Portable Model 2HO for bending of steam and gas pipes to 2-in. extra heavy pipe for heavy wall tubes has full power return—a roller contact between pump handle and high pressure plunger to reduce wear and fatigue. It develops 8 tons thrust at 6000 psi. Open-type wingheads provide full visibility bending, freedom from obstructions, speedier handling, and easier access for maintenance.

Standard tools are available for ½, ¾, 1, 1¼, 1½, and 2-in. pipe. Unit is also available with tube and flat bar dies. New weight is 135 lb (including case); price is $287.50 fob.

Wallace Supplies Mfg Co, 1304 W Diversey Pkwy, Chicago 14, Ill

MORE DATA? Circle 91, inside back cover



EXTRA LENGTH DRILLS, made of high speed steel, are designed for operations where inaccessibility is a problem, or for extremely deep holes. Diameters range from No. 52 wire gage to 1½ in.; overall lengths to 23½ in. larger diameters and longer lengths can be furnished—*Whitman & Barnes, 40600 Plymouth Rd, Plymouth, Mich*

MORE DATA? Circle 92, inside back cover

AMERICAN

Write:
AMERICAN TWIST DRILLS
A Subsidiary of
Brown & Sharpe Mfg. Co.
14301 West Chicago Blvd.
DETROIT 28, MICHIGAN

MAGNESIUM JIG CUTS COST OF DRILLING CASTINGS $3.08 PER UNIT!

By using magnesium tooling plate in place of steel, Worthington Corporation reduced the weight of tumble drill jigs from 125 pounds to 35 pounds. Used for close-tolerance drilling of castings, the magnesium jig can be turned by hand instead of by a chain hoist required for the heavier steel jig. This means a saving of $3.08 on every casting processed through the jig. And fabrication cost of the magnesium jig is 60% less than that of a steel jig.

Magnesium tooling plate can result in savings in your production operations. Its lightness, flatness, machinability and dimensional stability are ideal for fabricating accurate, easy-to-use jigs, fixtures, templates, gages, and for other tooling uses. For more information, write THE DOW METAL PRODUCTS COMPANY, Merchandising Dept. 1103F4-3, Midland, Michigan.

DOW **THE DOW METAL PRODUCTS COMPANY**
Division of The Dow Chemical Company

CIRCLE 234 READER SERVICE CARD

DOW

GET FAST DELIVERY OF MAGNESIUM TOOLING PLATE FROM THESE DISTRIBUTORS

Baltimore, Maryland
Clendenin Bros., Inc.
EAstern 7-4500
Charlotte, North Carolina
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EDison 4-5385
Chicago, Illinois
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MErrimac 7-2700
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Copper and Brass Sales, Inc.
VUlcan 3-8100
Dallas, Texas
Joseph T. Ryerson & Son, Inc.
FEderal 1-4311
Detroit, Michigan
Copper and Brass Sales, Inc.
FOrest 6-6200
Grand Rapids, Michigan
Copper and Brass Sales, Inc.
EMpire 1-6681
Hialeah, Florida
Fullerton Metals Co.
TUxedo 8-8424
Indianapolis, Indiana
Hubbell Metals Inc.
STate 7-1341
Kansas City, Missouri
Hubbell Metals Inc.
BAltimore 1-7760
Louisville, Kentucky
Hubbell Metals Inc.
MElrose 7-2595
Los Angeles, California
Reliance Magnesium Company
LUdlow 3-6361
Lyndhurst, New Jersey
A. R. Purdy Co., Inc.
WEbster 9-8100
Marietta, Georgia
Hubbell Metals Inc.
427-5551
Memphis, Tennessee
Hubbell Metals Inc.
WHitehall 8-1661
Milwaukee, Wisconsin
Fullerton Metals Co.
HUmboldt 1-6900
Minneapolis, Minnesota
Fullerton Metals Co.
STerling 1-3456
Portland, Oregon
Eagle Metals, Inc. of Oregon
ATlantic 8-5201
St. Louis, Missouri
Hubbell Metals Inc.
FRanklin 1-0212
Seattle, Washington
Eagle Metals Company
PArkway 3-9974
Spokane, Washington
Eagle Metals Company
KEystone 4-0586

THE DOW METAL PRODUCTS COMPANY

DOW

CIRCLE 235 READER SERVICE CARD

All-Transistor Electronic Gager Operates Completely on Batteries

The Electro-Probe, a new electronic gaging unit, has a small gage head and lightweight, all-transistor amplifier-meter which is battery operated. This use of transistors and battery power is said to provide high reliability and instant operation without need for warm-up time usually required by precision electronic equipment.

Any two of six different gaging ranges, from 0.0002 to 0.010 in., can be combined in the amplifier-meter, thereby providing magnifications up to 11,000X. Scales are correlated and provide minimum graduations from 0.000,010 to 0.0005 in. depending on the two scales selected. Total weight is 6½ lb.

Federal Products Corp, Providence 1, RH

MORE DATA? Circle 93, inside back cover

Olson Chip Wringer Reduces Costs, Speeds Oil Reclamation

Even after long periods of draining in a settling tank, metal chips or turnings still contain as much as 2½ to 3 gal of cutting oil per 100 lb. Manufacturer claims that by running these chips for not more than 3 minutes in this chip wringer, at least 90% and as much as 99% of the cutting oil remaining in the chips is removed. This means that as much as 2.94 gal of additional cutting oil is reclaimed from every 100 lb of chips. In not more than 3 minutes, the wringer reclaims again as much oil from every 100 lb of chips as can be recovered in from 12 to 24 hr with a settling tank.

Features include dynamically balanced sheet-iron basket; Meehanite metal curb and base; heat-treated steel, self-balancing spindle; automatic spindle oiling device; self-locking brake with electrical interlock; and vertical motor V-belt drive with pushbutton operation.

Olson Filtration Engineers, Cincinnati 12, Ohio

MORE DATA? Circle 94, inside back cover

Improved Quickgages Now Contain Built-In Rectification

Each AAC Quickgage contains its own built-in rectificaiton so that it operates directly from any on-off switch. Using a square, scale, or sample workpiece, the gage is positioned on a steel plate clamped behind die. On-off switch is placed at any point convenient to the operator. When switch is on, gage holds its position magnetically, requiring no mechanical clamping. (When switch is off, gage can be easily moved along the plate to any other position either from the front or the back of the machine). Micrometer vernier adjustment to 0.001 in. can then be made by rotating Quickgage dial with Q-wrench.

Built-in shock absorbers prevent shifting under impact so that the lightest sheet aluminum or the heaviest sheet steel can be gaged with the same accuracy and with equal speed. They can be used on press brakes, presses, and shears, and for such work as back or front gaging, step gaging, multiple bending, and special positioning, as well as for mounting AAC magnetic gages.

American Actuator Corp, PO Box 384, Stamford, Conn

MORE DATA? Circle 95, inside back cover

Why TWO HOLE FINISHING TOOLS?

For fine surface finishing (2-10 microinches) either tool will give excellent results. They differ in *speed*, final *accuracy*, *what* hole preparation is required and the *degree* of hardness achieved.

	BEARINGIZER	ROLL-A-FINISHER
speed	150 ipm	20-50 ipm
accuracy	low tenths	some improvement over hole preparation
work preparation required	close preparation because of limited ductility of materials under cold forging	rough bored hole
surface hardness	increased 10-30%	increased 5-10%
tool wear	compensated by replacing rolls	compensated by simple adjustment
thin wall structures	special fast rise cam construction maintains roundness	creates out-of-round conditions

Your local Cogsdill engineering representative will be glad to recommend the proper tool for you and will work with your staff to insure proper use and performance.

For the complete story on better finishes, write for catalog

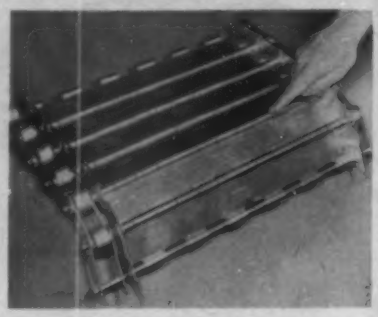
Cogsdill
TOOL PRODUCTS, INC.
12980 W. EIGHT MILE ROAD • OAK PARK 37, MICHIGAN
Western Branch: phone PL 3-3321, Los Angeles — In Canada: Barmac Ltd., Toronto

CIRCLE 236 READER SERVICE CARD

IS INTERFEROMETRY THE ANSWER TO BETTER INSPECTION DEVICES?

The interferometer is playing an ever-growing role in industry's search for better inspection equipment. The latest thinking in this field—and how it can be used in the shop—is contained in a 16-page reprint from the June 13, 1960 issue of AM/MM. It's available for only 35¢ from

Reader Service Department
American Machinist/Metalworking Manufacturing
330 West 42nd Street, New York 36, N. Y.



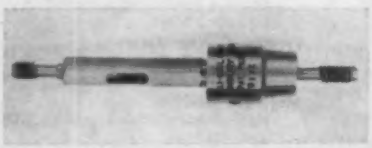
Hinged-Steel Conveyor Belting Has Short-Pitch Belt Links

Heavy-gage steel belting's shorter pitch link permits a considerable reduction in overall section depth of conveyor designs. New link design is compatible with existing conveyors using hinged-steel belting. Fabricated from ⅛-in.-thick steel, each individual belt link has a 2½-in. pitch; shorter pitch allows the assembled hinged-steel belt to run on sprockets with a PD as small as 5 in. As a result, conveyor depth can be as little as 8½ in.

Belting using these new links can be supplied in virtually any practical width. Individual links are produced in widths up to 18 in. Belts wider than 18 in. are assembled by threading multiple links on the through rods.

May-Fran Mfg Co, 1710 Clarkstone Rd, Cleveland 12, Ohio

MORE DATA? Circle 96, inside back cover



Depth Gage Handle Is Adjustable

Universal adjustable depth gage handle permits gaging both size and depth of all drilled and tapped holes in one operation. Because of adjustability, it dispenses with the need for grinding a step on the go-nib for each individual thread size and depth and permits the gaging of multiple holes of similar size and depth.

Handles are available in four sizes and may be used with American Standard thread gages for measuring standard tapped holes, and with a pin gage for measuring drilled holes, in addition to the full line of Heli-Coil thread gages. Prices range from $3 to $4.90 each.

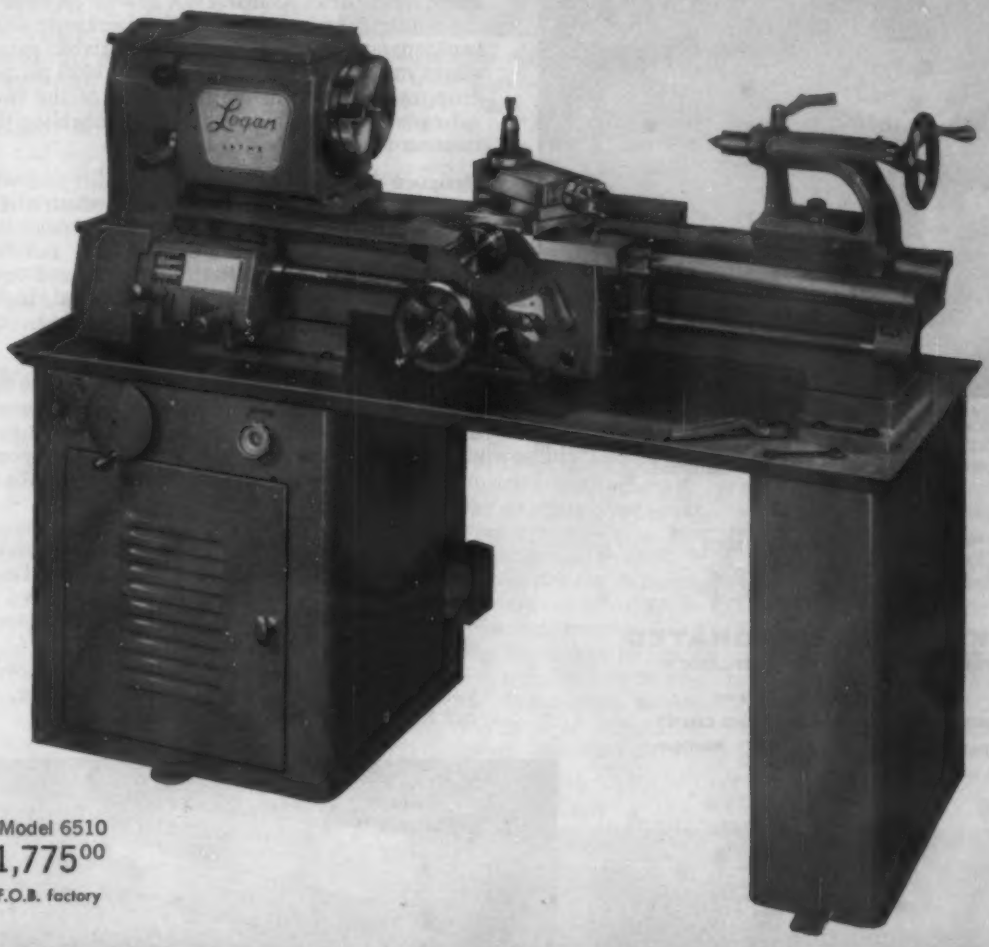
Heli-Coil Corp, Shelter Rock Lane, Danbury, Conn •

MORE DATA? Circle 97, inside back cover

NEW!

Logan | 14" LATHES BEST DOLLAR VALUE IN THE LATHE FIELD

These new Logan 14" swing lathes are **DEPENDABLE.** Their capacity permits a broad range of machining operations. They have a 14⅝" swing over bed, a swing over saddle cross slide of 9", and a center distance of 28". Logan lathes are **ACCURATE.** The ball bearing spindle has a 1⅜" hole and a draw in collet capacity of 1 1/16". The variable speed drive (40 to 1400 RPM) adjusts while lathe is running—no need to stop and shift belts! Also, the two V-ways and flat ways of the lathe are precision ground. Logan 14" swing lathes are **RUGGED.** The 10" wide and 56" long lathe beds are braced by oversize ribs to withstand torsional stresses. Feature for feature, the Logan 14" lathe is your best dollar value. The proof's in the product. No other lathe in this price category offers you this same big work capacity with variable speed drive. Write today for complete specifications.



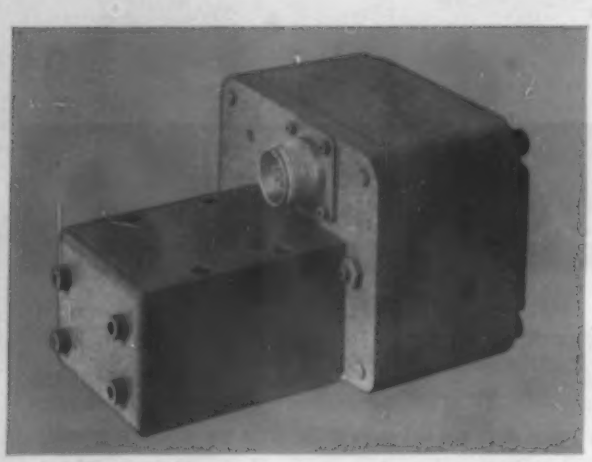
Model 6510
$1,775.00
F.O.B. factory

Logan

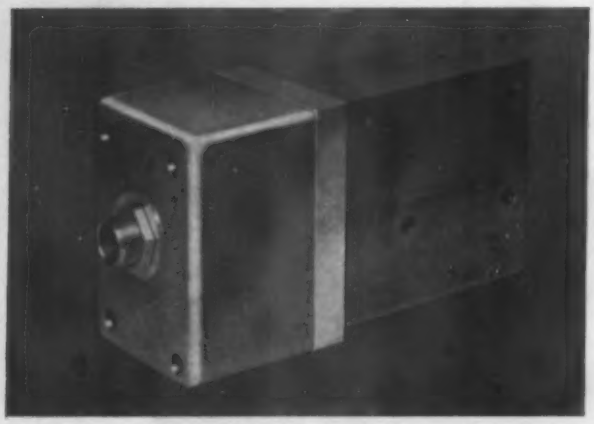
LOGAN ENGINEERING CO., DEPT. G-461
4901 W. Lawrence Ave., Chicago 30, Ill.

Servo Valves To Match Your SPECIFIC Needs

Ruggedness, dirt tolerance, reliability, low cost and compatibility with standard hydraulic components featured in complete line



NEW series SC4 single stage servo valves are latest additions to the complete Vickers line. Rated at 0-3 gpm, they combine high performance with flexibility and ruggedness.



Two complete series of two-stage valves cover system requirements from 0-17 gpm and 0-37 gpm. With several models in each series, system needs can be precisely satisfied.

Extremely accurate flow modulation for fast, precise closed-loop control of position, velocity, and acceleration is offered in the complete line of Vickers servo valves. They are specifically designed for industrial applications with a range from 0 to 37 gpm.

Low cost of all servo valves in the line is the result of being designed for production economies. In addition, the inherent simplicity of the Vickers design pays off further when occasional service or cleaning is needed —in most cases the valves *do not have to be returned to the factory for service.*

Three Basic Series Available—A new single stage design rated from 0 to 3 gpm with 350 psi pressure drop, and two separate series of two-stage variable gain servo valves rated to 17 and 37 gpm, with 1000 psi pressure drop, are included in the line. Each of the two-stage valves is available in several models enabling the user to select the best valve for the job.

Designed To Take It—Temperature, dirt and vibration conditions normally encountered in industrial applications will not affect accuracy or performance of these servo valves when they are used with standard, 10 micron full flow filters. Both the single and two stage valves are equipped with large industrial, high force torque motors and will not clog or stick when operated with clean industrial hydraulic oils.

Part of Complete Line—Of equal importance for continued system accuracy and reliability, these servo valves are part of the complete line of high quality hydraulic products available from Vickers. Thus, responsibility for efficient operation of the entire hydraulic system rests with a single source.

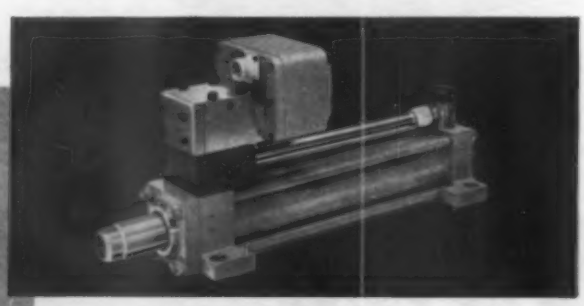
Complete pre-engineered servo systems using the Vickers "Building Block" concept can be provided for many installations to reduce development and engineering costs. Such systems can include: servo valves, motors, hydraulic power supplies, electronic amplifiers, electrical feedbacks, etc.

Your nearby Vickers application engineer will assist you with your specific requirements or write, wire or call for Bulletins 59-74, 61-79.

VICKERS

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1410 • Detroit 32, Michigan

9508



Servo valves can be mounted separately or combined in one package with Vickers servo motors or hydraulic cylinders. All components for a complete system—either custom engineered or "Building Block"—are available from Vickers.

$28 Million Incentive Contract to GE

General Electric has an Air Force contract for development of the nose cone for the advanced Titan II ICBM. Incentive contracts are rather uncommon in the missile R&D field. Under it, GE could receive fees in addition to the amount stipulated upon signing, or pay penalties that would be subtracted from the amount. Payment would depend upon meeting or failing to meet performance criteria such as scheduled delivery date or quality standards.

Lord Chemical Corp . . .

. . . York, Pa, subsidiary of Wheelabrator Corp of Mishawaka, Ind, will now be known as the Lord Chemical and Equipment Division of Wheelabrator. Division will continue its manufacture of finishing equipment, media, and compounds in York and Red Lion, Pa. The Lorco name will apply to all products of the division; formerly, barrel finishing and wet blast models were identified as Techline products as were media and compounds for barrel finishing and abrasives for wet blasting.

B-70 Progress at Lockheed

Tooling program for the B-70 Valkyrie upper intermediate fuselage is moving on schedule at Lockheed's Georgia Division at Marietta. The division is subcontractor on the B-70 section which is about the size of a freight car; North American is prime contractor for the Mach 3 bomber.

Production on the first of some 30 brazing fixtures for bonding stainless steel honeycomb is well under way. These ceramic and steel tools, some almost the size of a one-car garage, are the heart of the B-70 fabrication program. In use, the fixtures will subject the honeycomb layup to temperature extremes ranging from +1700 to –100 F. Stronger and lighter than aluminum, it'll withstand the extremely high temperatures generated by the B-70's 2000 mph speed.

Massive generator rotor, forged and machined at US Steel's Homestead (Pa) District Works, is being machined on a 120-in lathe in the plant's forge division. Manufactured for General Electric Co, the rotor weighed in at 228,870 lb prior to shipment, making it one of the largest ever produced. It is 38 ft 9 in. long and has a maximum diameter of 59¾ in. for 20 ft of its length. When installed in the completed generator, the rotor will spin at 3600 rpm

Vermont Firm Acquires Two NY Metalworking Companies

Shelburne Industries, Burlington, Vt, manufacturer of specialty wire goods and metal stamped housewares, has purchased all of the assets of C B Woodworth Corp of Greene, NY, and Woodworth Specialties Corp of Binghamton, both custom metalworking firms established more than 25 years ago. The two companies will be operated as the Woodworth Metal Fabricating Division of Shelburne and will continue operation in the Binghamton area.

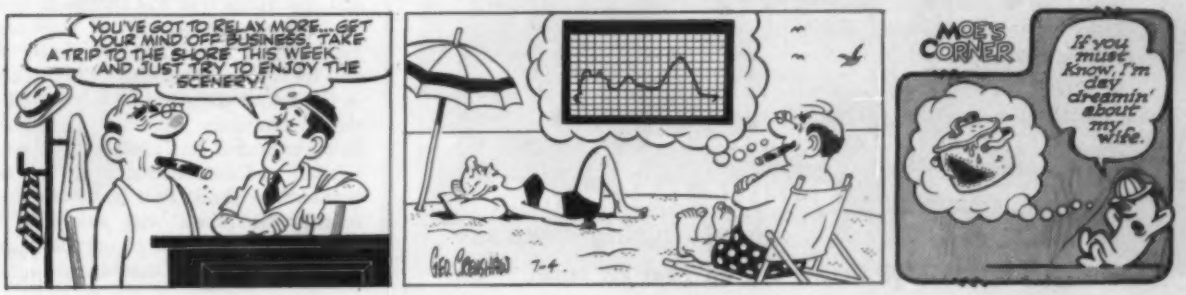
New Chemical Treating Process Developed for Metals

C-Tron is the tradename of a process that may be applied to a wide range of metals including aluminum, copper, zinc, lead, tin, and magnesium. Developed by Crown Chemical Metals Corp (a division of Crown Chemical Corp of Providence, RI), it's reported to greatly improve working characteristics and physical properties of these metals without altering the original analysis.

Applied in the molten state, the process results in an immediate, visible action on the surface properties of the melt. Fluidity is greatly increased, allowing a lower pour temperature and much less critical attention to mold filling. Castings are said to be sharp and easily removed, require less touch-up, and shrinkage porosity is virtually eliminated.

McGIRK'S WORKS

by GEO. CRENSHAW


YOU'VE GOT TO RELAX MORE...GET YOUR MIND OFF BUSINESS, TAKE A TRIP TO THE SHORE THIS WEEK AND JUST TRY TO ENJOY THE SCENERY!
MOE'S CORNER
If you must know, I'm day dreamin' about my wife.

TORIT DUST COLLECTION ENDS THIS:

"OUT OF PRODUCTION FOR THREE DAYS? THAT'S WHEN WE'RE SUPPOSED TO SHIP!"

"And believe me, that wasn't all the boss said! Two key machines were so clogged with dirt and grime we had to disassemble and clean them—overnight! Between overtime for the repair crew and our own crew, I managed a partial shipment in three days. And I made up my mind this wasn't going to happen again!

"I'd heard of preventive maintenance with Torit Dust Control equipment—and the Torit representative I called sure opened my eyes! Clean machines hold close tolerances better and up to 80% longer! Torit collectors remove over 99% of dust and air-borne debris, save on both the cost and frequency of servicing.

"I expected there'd be a hitch on prices—but look what I found out: our production breakdown cost nearly as much as the Torit equipment we needed! And just while Torit Dust Collectors are being depreciated we'll make money on them —through maintenance savings, improved production, and reduced down-time!

"The boss actually congratulated me when I showed him the savings Torit preventive maintenance gives us!"

Torit Dust Collectors stop dust build-up before it costs you money. They're available in both high efficiency cyclone and cabinet type units. Why not check into them today—write:

TORIT manufacturing company

Dept. 420, 1133 Rankin St., St. Paul 16, Minn.

Basically, the process is one of purification, removing such contaminants as hydrogen, oxygen, nitrogen, and sulfur—even the walls of the furnace and handling equipment are cleaned. Extrusion rates can be increased, and ductility and tensile strength are improved. The chemical employed in the process are completely expended and leave no residue to alter analysis of the original melt.

O'Neil-Irwin Name Change

Di-Acro Corp is the new name of O'Neil - Irwin Manufacturing Co, Lake City, Minn. Di-Acro comes from "die-accuracy without dies," one of the company's early marketing themes, and a brand name which has been promoted through the years almost to the exclusion of the O'Neil-Irwin corporate name.

During the past 15 years the product line has increased from three types of precision metalworking machines in ten sizes to ten types of machines in more than 60 different sizes. More recently the firm has entered the field of expendable items with a complete line of punches and dies and press brake dies for use in punch presses and press brakes.

Metals & Controls Inc . . .

. . . Attleboro, Mass, has formed a Thermostat Metals Application Engineering Department to provide additonal technical service for users of thermostat metals. It'll make available, without cost, a task force of engineers offering design assistance, seminars for cost reduction, help in selecting the correct thermostat metal type for any application, and solutions to specific processing problems such as welding, forming, heat treating, and plating.

Dynapaks Going to Japan

Agreement appointing Nichimen Co of Osaka as general agent for sale and distribution of the Dynapak line of high-energy-rate metal forming machines in Japan has been entered into by General Dynamics Corp. This is GD's first distribution of the machines overseas. The first Dynapak to be exported to Japan will be exhibited and demonstrated at the International Trade Fair in Osaka this month. Nichimen will establish a separate department to handle sales and service for the machines.

Cast-Master Moving Operations

Cast-Master, a department of Koehring Co's H-P-M Division since it was acquired in 1959, is moving its entire manufacturing and administrative operations from its present location in Bedford, Ohio, to H-P-M facilities in Mt Gilead, Ohio. Company manufactures die-casting machines. Move is scheduled for completion by July 1 and most of the work now in progress at the Bedford plant will be completed by that time.

Reed Instrument Expanding

Construction of a $2.5 million plant for Reed Instrument Bearing Co, a division of SKF Industries, is underway in Los Angeles. Expansion of the Reed division will enable SKF to quadruple production. Scheduled for completion in August, the 35,000-sq-ft facility will contain the most modern White Room in the nation, according to company spokesmen. Employment of 175 at Reed's present Los Angeles location is expected to more than double at the new plant.

New Division at Taylor Fibre

Taylor Fibre Co, Philadelphia manufacturer of laminated plastic and vulcanized fiber, has set up a new division to provide design assistance and manufacturing facilities for pilot and full-scale production of filament-wound reinforced plastic parts. The technique makes parts with the strength of steel and weight less than that of aluminum; it's done by utilizing the extremely high strength of glass filaments in tension to absorb loading stresses.

Creation of the Filament-Wind-

AM/MM

"We're making a few incidental changes, Miller. Do you have overalls?"

NEW . . . ALL NEW . . . FROM

KALAMAZOO

The "BIG K"

Now, after more than four years' research, Kalamazoo brings to you the all new Model 14A — horizontal metal cutting bandsaw. Incorporating some 30 shop proven, cost saving features, this hydraulic driven, heavy duty bandsaw offers cutting capacity and ability in excess of *any* cut-off method, at far less tool cost per square inch of cutting.

Most important among these profit producing features are: positive control force feed; clockwise blade rotation to reduce teeth shock — increase blade life; convenient 36" machine height to reduce operator fatigue; large 14" x 24" capacity; push button control; dual movable vise jaws; adjustable blade tension.

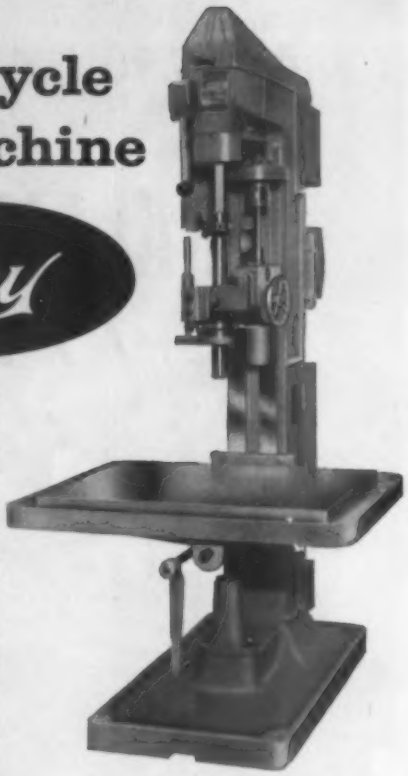
For complete details on this amazing new machine tool, phone, write or wire your Kalamazoo representative. Facilities for test runs of your material on the "Big K" are at your disposal — at no obligation.

MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Company

508 Harrison St.
Kalamazoo, Mich.

automatic cycle drilling machine

Avey



You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit. Adjustable rapid power traverse, feed, and rapid return of the spindle permit automatic transfer or rotary index fixturing. You also get adjustable feeds, speeds, table travel, head travel, and Avey's precision spindle. Morse Taper 2, 3, or 4; single or multiple spindles 1 to 5 hp. *Write or phone for data.* Avey, Box 1264, Cincinnati 1, Ohio.

CIRCLE 243 READER SERVICE CARD

Easy Operation, Precision Measurements ...with Wilson "Rockwell" Hardness Testers

No matter what your hardness testing requirements are, there's a Wilson Rockwell instrument to do the job easily and accurately. Wilson instruments on the production line and in the laboratory offer these advantages:

Accuracy—Precision-built, with exact calibration, for consistently correct results.

Easy operation—Even an unskilled operator can get perfect readings. All controls conveniently grouped.

Long life—Simple design, rugged construction make Wilson instruments as durable as a machine tool.

Easy maintenance—Interchangeable mechanisms, with spindles mounted in oil-less bearings.

Complete line—Choose from the widest variety of instruments available, including semi and fully automatic models and Wilson "Brale" diamond penetrators.

Write for details—Ask for Catalog RT-58. It gives complete information on the full line of Wilson Rockwell hardness testers and accessories.

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

ing Division marks a further move in Taylor's diversification program which last year saw the acquisition of Dytronics Inc, a subsidiary producing stamped circuits for electrical and electronic applications, and the creation of an Advanced Materials Division for R&D work in high-temperature, high-strength laminates.

Navy Contract to Ford

Ford Motor Co has received a $3.8 million contract from Navy's Bureau of Ships for a joint Army-Navy development of a 600-hp gas turbine engine. The three-year R&D contract was awarded to Ford following a design competition among ten major companies active in the gas turbine and aircraft engine field. Order calls for a compact, light-weight turbine with fuel economy comparable to that of internal combustion reciprocating engines. Design, fabrication, and testing will be done by the Turbo Machines Dept, Engineering and Research Staff.

It'll be applicable to boats, amphibious vehicles, trucks, tanks, field power generators, and many other military uses. Power requirement is exactly double that of Ford's recently announced 704 gas turbine which delivers 300 hp.

$3 Million Order to Burroughs

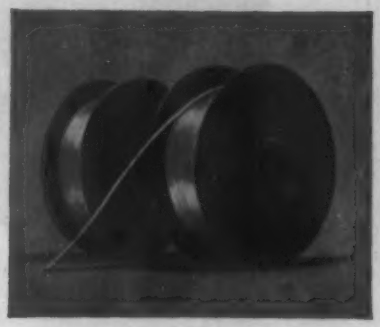
Burroughs Corp, Detroit, has a $3.5 million AF contract for installation and logistic support of data processing equipment for the SAGE program of North American air defense. •

AM/MM

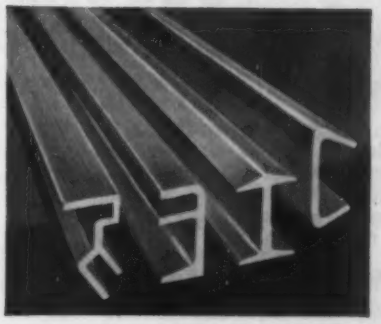
"She works in the office in the daytime and he works the night shift."

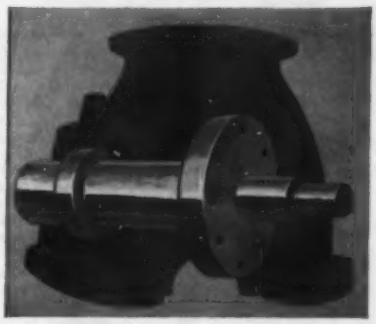
A simple, effective, low cost rust and corrosion control that . . .

- *is easy to apply*
- *eliminates moisture*
- *prevents corrosion*
- *need not be removed*



CRC 3-36 has a dual action which first removes moisture from the surface, driving it out of grain boundaries, cracks and pores. It then forms a thin molecular film of approximately 2 microns over the surface and seals it against subsequent deposits of moisture and the action of corrosive atmospheres.





For Castings & Large Machined Parts

A steam turbine manufacturer, after exhaustive tests, now uses CRC 3-36 exclusively to protect metallic surfaces of parts and equipment in various stages of manufacture from deterioration due to corrosion. After standardizing on CRC 3-36, the necessity for stocking, coding and handling a wide variety of products was eliminated. In addition, CRC 3-36 does not have to be removed before subsequent processing. Substantial savings are being realized through the use of CRC 3-36.

This manufacturer has also found that CRC 3-36 will protect all metallic surfaces from rust and corrosion during shipment.

For Extruded Aluminum

An aluminum manufacturer received complaints that bright aluminum extrusions arrived at distribution points covered with a dull coating of oxide. Exhaustive tests under actual shipping conditions show that an inexpensive coating of CRC 3-36 eliminated oxidation during shipment and that distributors, in turn, could ship bright and shining extrusions months later to customers with no complaints about oxidation. Furthermore the extrusions were ready-to-use as CRC 3-36 does not have to be removed.

For Manufacturing Processes

The manufacture of welding wire poses a corrosion problem from coolants used to lubricate and cool dies used in the rolling or drawing process. One manufacturer of welding wire tried applying CRC 3-36 before running the stock through the mill and obtained excellent results. Now all stock is coated with CRC 3-36—corrosion is controlled and no stocks are lost due to rust.

New! CRC Soft-Seal for Severe Conditions

If you are using expensive interior storage space for metal stocks, dies, jigs and fixtures, these may be coated with Soft-Seal and stored outside to release inside space for productive use.

For further information, write to
Corrosion Reaction Consultants,
A SUBSIDIARY OF
THE CHAS. J. WEBB SONS CO., INC.
116-D Chestnut Street, Phila. 6, Pa.,
or telephone WAlnut 5-0200.

CRC

Metal Protection for
MANUFACTURING • STORAGE • PACKAGING

Ask your local industrial distributor for a trial supply.

FORMULA 3·36 METALS INDUSTRY

FAST, ECONOMICAL CUTTING

of ferrous, non-ferrous, non-metallic solids and shapes

STONE
M-120
manual or automatic
CUT-OFF MACHINE

A heavy-duty, 20"-blade, chop-stroke machine, the M-120 will handle your heaviest jobs better in faster time. Cuts to close tolerances with a mill-like finish, without hardening stock or changing its characteristics. Cuts ferrous metals up to 4" solids, 6" structurals and heavy-wall tubing . . . and non-ferrous metals up to 6" solids, 8" structurals and extrusions and 6" heavy-wall tubing.

For automatic bar feed operation the M-120 is electro-air oil-check operated for up to 1600 cuts per hour through both ferrous and non-ferrous metals.

CHECK THESE STONE FEATURES

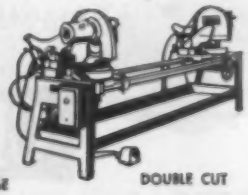
Geared-in-head motor (a Stone exclusive) . . . fast-acting, self-centering vises . . . heavy cast machine-surfaced table for jigs and fixtures . . . wide range of gear ratios for proper spindle speed . . . oil mist spray for non-ferrous cutting.

WORLD'S MOST COMPLETE LINE

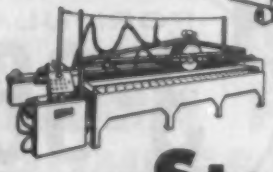
Used by every major industry throughout the civilized globe, Stone machines offer the world's most complete line of Chop-Stroke, Double Miter and Traverse-Type Machines . . . either manual, semi — or fully automatic or custom-built. All fully described in new literature featuring latest developments and improvements. Send for it today.

AUTOMATIC CHOP STROKE

DOUBLE MITER



DOUBLE CUT



TRAVERSE

Stone MACHINERY CO. INC.
151 FAYETTE ST., MANLIUS, N. Y.
HIGH SPEED CUTTING MACHINERY

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 NUMERICALLY CONTROLLED MACHINE TOOLS—*National Automatic Tool Co, Richmond, Ind.* 8-page bulletin 157-2 provides information on Natcotrol, Natco's own numerical control system, which provides two or three-axis control for single or multiple spindle machines. Standard 1-in. 8-channel punched tape feeds information into this completely electro-mechanical system. Bulletin supplement describes and illustrates the new Natco single-spindle, numerically controlled drilling, tapping, and milling machine available with either automatic or manual tool changing.

2 ENGINE LATHES—*R K LeBlond Machine Tool Co, Madison at Edwards Rd, Cincinnati 8, Ohio.* 19-page bulletin R-215 presents illustrated description of new 13, 15, 17, and 19-in. Regal units. Advantages, design features, detailed specifications included. Specifications and operating descriptions of the Regal 17 and 19-in. plain and sliding gap lathes are also provided.

3 NUMERICALLY CONTROLLED TURRET DRILL—*Fosdick Machine Tool Co, Cincinnati 23, Ohio.* 6-page illustrated bulletin FTD-1 contains data on the Fosmatic—a complete drilling department in one machine. 32 spindles in a revolving turret hold enough tools for hundreds of drilling, tapping, and milling operations. Numerical control ups production and practically eliminates scrap with this machine.

4 NUMERICALLY CONTROLLED MACHINE TOOLS—*Sundstrand Machine Tool, Belvidere, Ill.* 14-page bulletin discusses "Engineered Production" with numerically controlled machines. Presents illustrated descriptions of 2-axis Jigmatic positioning table; 3-axis turret-type machine; 3-axis single spindle rail-type machine with 20-position automatic tool changer; 3-axis horizontal machine; 5-axis Omnimil for operation under positioning or contouring control. Tooling and adaptors for machines pictured and briefly described.

5 AUTOMATIC CHUCKING MACHINE—*Brown & Sharpe Mfg Co, Providence 1, RI.* 4-page bulletin SM45 gives information on the No. 2, designed to perform facing, forming, turning, drilling, and threading operations. Work up to 3 in. dia can be gripped internally and externally in its air-operated chuck. Round, square, hex, or irregular shaped parts can be handled. Cost-saving features and specifications included.

6 BUILDING BLOCK MACHINE TOOLS—*S & S Machinery Co, 140 53rd St, Brooklyn 32, NY.* 8-page brochure illustrates and describes Henschel modular building block units. New specialized machines, automated equipment, conversions of existing planer, milling, and drilling equipment are covered.

7 JOB PORTFOLIO FOR MULTI-SPINDLE AUTOMATICS—*Warner & Swasey Co, 5701 Carnegie Ave, Cleveland 3, Ohio.* 64-page book illustrates, complete with all technical details, efficient metal cutting jobs run on W&S multi-spindle automatics. Designed especially for production men who are involved with machining methods in the small lot field, it contains a mass of information on dozens of different workpieces and tooling applications. Each job is illustrated with dimensioned line drawings and complete setup sheet data. By comparing this information with jobs of similar shape and size in the

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reader's own shop, many new ideas and methods for improving machining operations can be gained.

8 TRACER LATHES — *Cazeneuve Lathes Inc, 601 E Linden Ave, Linden, NJ.* Circular pictures and describes Model HB 500 and HB 575. Specifications and dimensions included.

9 CROWN-GEAR GRINDER — *Michigan Tool Co, Gear Grinding Division, 7171 E McNichols Rd, Detroit 12, Mich.* Technical data sheet gives complete specifications and describes operations of Model CGG-16x18FA, a fully automatic unit. Details are included on the various cycles of rough, semi-finish, and finish grinding; rates of feed; wheel dressing; compensation for wheel wear. Semi-automatic and manual cycles can also be set up. This grinder can be used on spherical gear teeth, spur gears, and splines.

10 "1961 MANUFACTURING PROGRAM"—*Misal, Via Vittor Pisani, 14, Milan 503, Italy.* 16-page catalog illustrates and describes some of the company's metalworking machine tools including a range of lathes, milling machines, shaping machines, grinders, slotting machine, high-speed saws, and radial drilling machines.

11 ABRASIVE BELT GRINDER — *Eastern Machine Screw Corp, New Haven 6, Conn.* 8-page catalog 100 contains details on the new Loungway rise and fall unit that is designed to replace many operations previously done only by hand grinding. Examples of parts produced on the grinder are pictured, including items requiring intermittent ground surfaces, fillets, and difficult contours. Construction details and specifications included.

TOOLS AND ACCESSORIES

12 TWIST DRILLS—*American Twist Drills, Subsidiary of Cutting Tool Div, Brown & Sharpe Mfg Co, 14301 W Chicago Blvd, Detroit 28, Mich.* 98-page catalog illustrates complete line including HSS, carbide tipped, solid carbide drills for hard steel, and special twist drills, together with pages of helpful drill pointing and engineering data.

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13 CERAMIC CUTTING TOOLS—*Carborundum Co, Dept BMD, PO Box 337, Niagara Falls, NY.* 23-page catalog 960 gives properties data on Stupalox tools, and specs and prices on throw-away inserts, heavy-duty button inserts, solid inserts, unground blanks, single point tools, and toolholders.

14 HIGH - FREQUENCY ELECTRIC TOOLS—*Thor Power Tool Co, 175 N State St, Aurora, Ill.* 32-page catalog 62 covers complete line including sanders, grinders, polishers, impact wrenches, screwdrivers, nutsetters, drills, reamers, and balancers. Front part of the catalog presents an analysis of high-frequency tools with a capsulized report on the advantages of using 180 360, or 400-c tools for specific applications.

15 TORQUE MEASURING INSTRUMENTS—*Power Instruments Inc, 7352 N Lawndale Ave, Skokie, Ill.* 12-page brochure illustrates how to measure the torque characteristics and speed of motors, gear trains, servo mechanisms, potentiometers. Covers torque ranges from ¼ gm-cm to 200 lb-in. Includes formulas for computing power and efficiency and methods of using stroboscopes and tachometers for analyzing rotating motion.

16 DRILLING AND TAPPING TECHNIQUES—*Heli-Coil Corp, Danbury, Conn.* 12-page bulletin 765 describes proper procedures for drilling and tapping aluminum, magnesium, steel, and thermoplastics and other plastics to receive Heli-Coil inserts. In addition to basic procedures, publication covers specific information such as proper selection of tap for boss material, tapping lubricants, close-in characteristics of magnesium, and class of fit. Complete H Limits chart for both aluminum and steel cutting taps is included. Features a nomograph from which user can determine the tapping speed and lubricant for a given size of tapped thread in a wide range of materials.

17 MILLING CUTTERS — *Futurmill Inc, 6960 Highland Rd, Pontiac, Mich.* 28-page catalog presents complete line of indexable blade milling cutters with illustrations, dimensions, style recommen-

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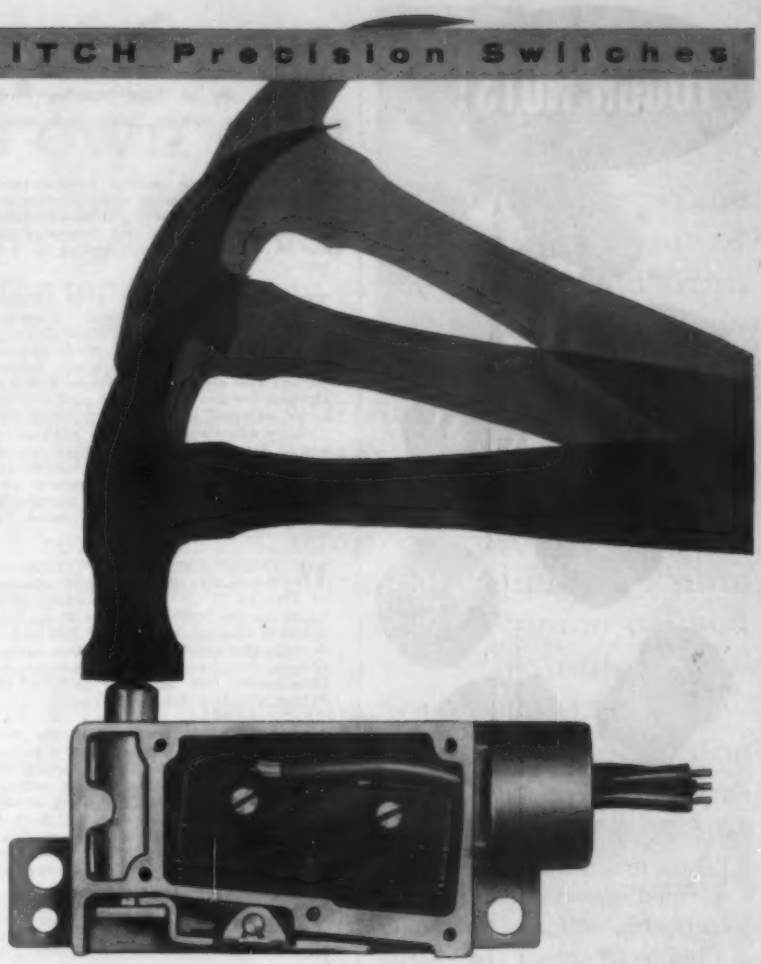

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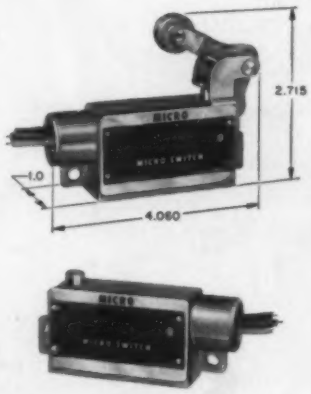
A controlled force is transmitted to the diaphragm-sealed plunger of the internal switching unit.



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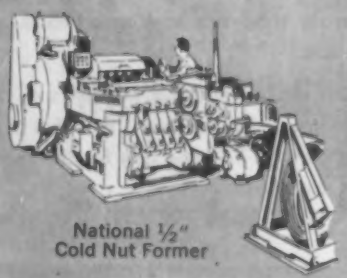

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dation for various milling methods and materials. Also contains technical data on milling feeds and speeds; trouble-shooting procedure; and factors that determine the degrees of finish, from roughing to low micro.

18 CUTTING FLUIDS AND LUBRICANTS — *Shear-Speed Chemical Products, Div. of Michigan Tool Co, 7125 E McNichols Rd, Detroit 12, Mich.* 52-page catalog covers 26 different types. Soluble concentrates are covered in three sections: 1) those for fine finishes and good tool life under extreme conditions; 2) those for stainless alloys and nonferrous application; and 3) for general plant use. More specialized cutting, honing, and grinding oils are covered in other sections. Features and uses of each fluid are discussed along with application hints and dilution tables for soluble concentrates.

19 RELIEF-GRINDING FIXTURE — *Harig Mfg Corp, 5787 W Howard St, Chicago 48, Ill.* 4-page brochure gives details on the Steptool fixture; shows how to use it to grind any type of drill and to do cam-relief grinding on an endless variety of tools. Also described are the infinite cam adjustments, how to locate tools in the fixture, grinding flutes, Helixpoints.

20 COUNTING INSTRUMENTS—*Durant Manufacturing Co, 1029 N Buffum St, Milwaukee 1, Wis.* 8-page catalog 200 presents all models needed to meet ordinary industrial requirements. Models are departmentalized according to actuating methods —stroke, revolution, electric and predetermined, and lineal counters. Descriptions and specifications given, as well as a reorganized price list.

21 PRESS BRAKE DIES—*Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* 4-page bulletin 92 provides information on new Tufloy line of standard stocked press brake dies. Described and illustrated, with specifications and application data, are the most widely used 90° and 30° air bend dies, flattening and offset dies, 3 and 4-way dies, and 90° gooseneck punches. Special punches and dies are pictured, plus ordering information.

HEAT TREATING AND WELDING

22 CONTROLLED ATMOSPHERE TEMPERING UNITS—*Ipsen Industries Inc, Dept 721, PO Box 500, Rockford, Ill.* Bulletin D-61 describes furnaces used for atmosphere tempering, annealing, and stress relieving. The Ipsen DFC-5-600 tempering furnace is illustrated and a cross-section diagram explains the details of the DU-4-600 atmosphere tempering unit which includes an insulated quench tank in addition to the 2-zone atmosphere cooling chamber. Temperature range of these units is 400 to 1500 F.

23 WELDER SERVICE MANUAL — *Federal Machine & Welder Co, Warren, Ohio.* 8-page brochure I-60 covers installation, starting, lubrication and maintenance of Federal welders. Data included on cleaning the cooling system; servicing of electronic controls; causes of imperfect welds; and recommended spare parts.

24 WELDING ALLOY WALL CHART —*All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY.* 19½ x 25½-in. chart has complete line of welding, brazing, and soldering alloys and fluxes for joining all commercial metals, indexed under common base metals. Included is a description of All-State's aluminum joining alloy line. Government specs met by company's aluminum alloys are given in tabular form.

25 DC WELDING UNIT—*National Cylinder Gas Division, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill.* Bulletin describes the Sureweld DRCP-33 welder which offers continuous voltage and slope adjustment and is especially adapted to critical welding jobs on light-gage metal. The unit has a range of 10 to 40 welding volts and is designed for the MIG welding process. Specification table gives current, capacities, and dimensions.

26 HARD SURFACING ELECTRODE —*McKay Co, 1005 Liberty Ave, Pittsburgh 22, Pa.* Data sheet provides information on Hardalloy 55, a high alloy, low hydrogen hard surfacing electrode designed to resist severe wear under high stress conditions. It has good out-of-position characteristics and operates either ac or dc reverse polarity. Sizes available are 1/8, 5/32, 3/16, and ¼ in. in standard 14-in. lengths. Each pound of electrode covers from 21 to 24 sq in., ⅛ in. thick.

27 BURIED BLAST BURNERS — *Eclipse Fuel Engineering Co, Combustion Division, Rockford, Ill.* 4-page bulletin H-42 describes Series ZB nozzle-mixing units. Nine burner sizes are listed in a choice of 54 maximum firing capacities from 60,000 to 14,500,000 Btu per hr. Concentric design of separate air and gas ports is said to prevent backfiring and to permit virtually limitless turndown from high firing. Due to this design they may be used in very high-temperature applications with preheated combustion air and/or oxygen enriched air. Diagrams illustrate the wide range of applications possible. Selection and sizing information includes dimensions and specifications.

PLANT SERVICE EQUIPMENT

28 BARREL PLATING EQUIPMENT —*Udylite Corp, 1651 E Grand Blvd, Detroit 11, Mich.* 16-page illustrated catalog gives major plating barrel specifications and recommendations for barrel assemblies, horizontal barrel units, loading stands, storage and transfer units, and final rinse units. Automatic machines, centrifugal dryers, heating and cooling coils, tank linings, and rectifiers are discussed.

29 WIDE BELT FINISHING—*Carborundum Co, PO Box 337, Niagara Falls, NY.* 4-page bulletin gives case study results where use of wide belts and wide

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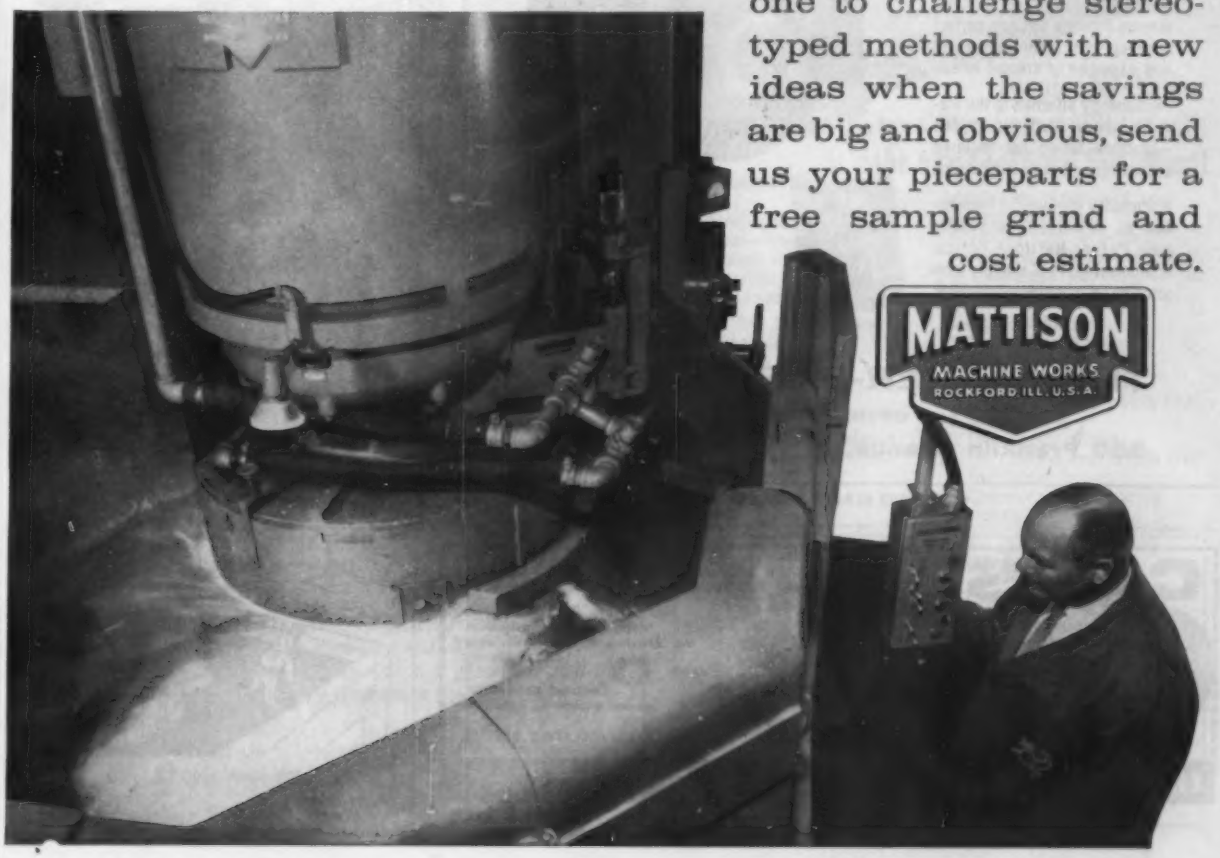

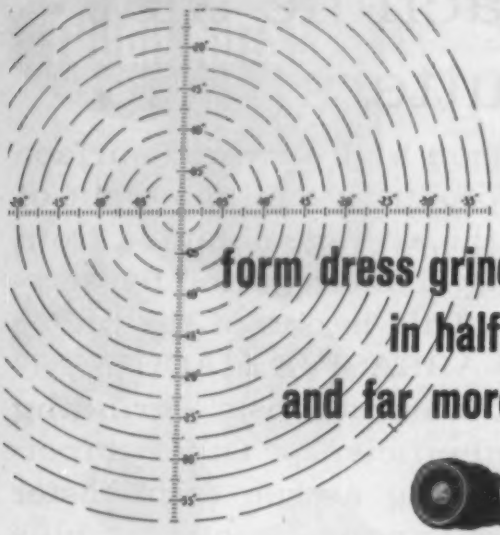

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belt machines for both wood and metalworking cuts costs and exemplifies production while maintaining quality.

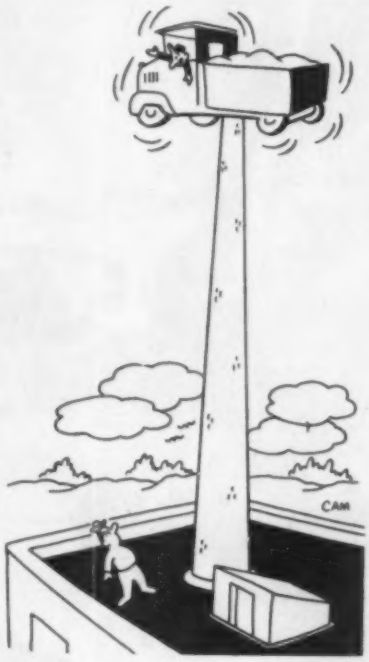
30 ELECTRIC HEATING EQUIPMENT —*Edwin L Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa.* 16-page catalog 975-D discusses Chromalox equipment including baseboard heaters, forced air wall insert heaters, radiant heaters, floor drop-in types, unit ventilators, industrial blower units, airduct heaters, and many types of controls.

31 TELEPHONE BOOTHS—*Burgess-Manning Co, 749 East Park Ave, Libertyville, Ill.* 4-page folder describes line of open-construction, acoustical telephone booths designed for noisy areas. Five models illustrated and discussed.

PARTS AND MATERIALS

32 METALS HANDBOOK—*American Society for Metals, Metals Park, Novelty, Ohio*—32-page illustrated brochure describes new 1300-page ASM Metals Handbook, 8th Edition, Vol 1, "Properties and Selection of Metals." Includes examples from each of the Handbook's major sections with information on how the book was compiled by 1335 metalworking experts in association with 83 author committees representing every area of the industry.

33 PLASTICS—*Industrial Plastic Supply Division of Industrial Safety Supply Co, 575 New Park Ave, West Hartford 10, Conn.* 192-page catalog covers over 800 different items including plastic sheet, rod, tube, film, bags, in such materials as Lexan, Polyester, Polypropylene, Penton.



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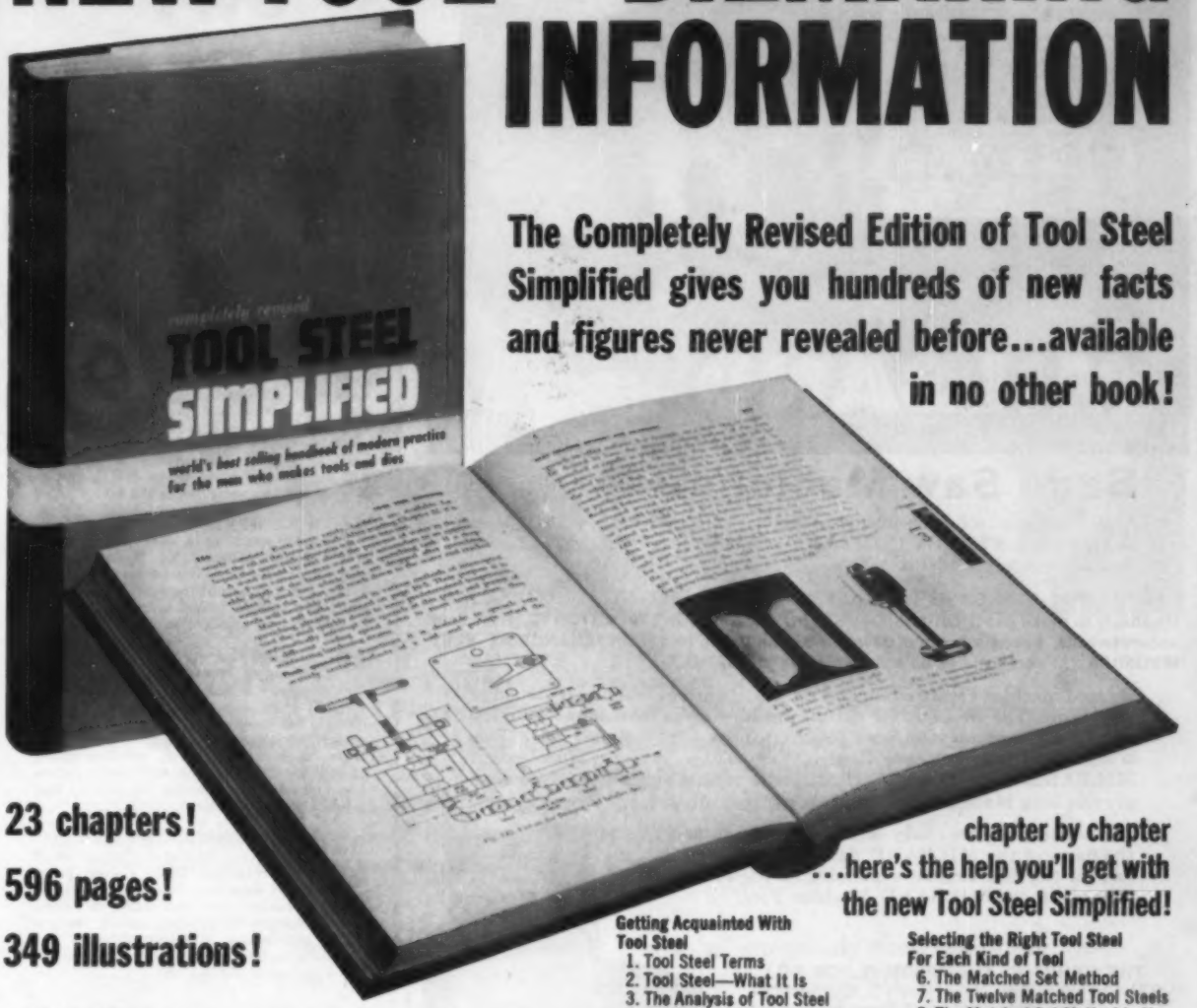

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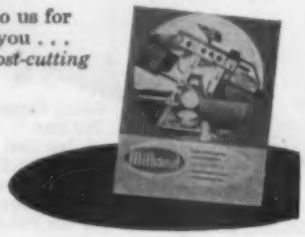

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34 VALVES AND FITTINGS — *Crane Co, 300 Park Ave, New York 22, NY.* 464-page illustrated catalog 60, with an enlarged metals and materials section, includes among new features such subjects as product weights, ASTM metal classifications on valve product pages, capacity tables for safety and relief valves, and bronze and iron valves shown with government specifications. Engineering data section has been revised and expanded to include information on the flow of fluids from Technical Paper 410 published by Crane.

35 BALL VALVES—*Homestead Valve Manufacturing Co, Coraopolis, Pa.* 8-page brochure, Section 5 of Reference Book 39, provides information on new line in combinations of metals, seats, and seals to handle practically any fluid. Offered now with flexible self-forming Teflon seats and seals, they will soon be available in other materials such as rubber, polyethylene, or Kel F. Sizes range from ¼ to 2½ in. for pressures up to 400 lb water-oil-gas, and temperatures to 450 F.

36 MULTI-SPEED MOTORS—*Century Electric Co, 18 & Pine Sts, St Louis 3, Mo.* 4-page bulletin 1300 discusses principal types — variable-torque, constant-torque, constant-horsepower. Both polyprase and single phase units are covered in addition to application information.

37 ADHESIVES SPECS — *Minnesota Mining & Manufacturing Co Adhesives, Coatings & Sealers Division, 900 Bush Ave, St Paul, Minn.* 54-page catalog lists official US government specs for a wide variety of adhesives, costings, and sealers. Lists, in numerical form, military specs, specifications definitions, intended application and the corresponding 3M product that meets these specifications.

38 RECIPROCATING TORQUE ACTUATORS — *Ex-Cell-O Corp, 945 E Sater St, Greenville, Ohio.* 4-page folder pictures and describes a new Midget Rotac. Rotac actuators use hydraulic or pneumatic pressure to produce rotary reciprocating movements. Midget models are used for light applications in instruments and in many other devices. •

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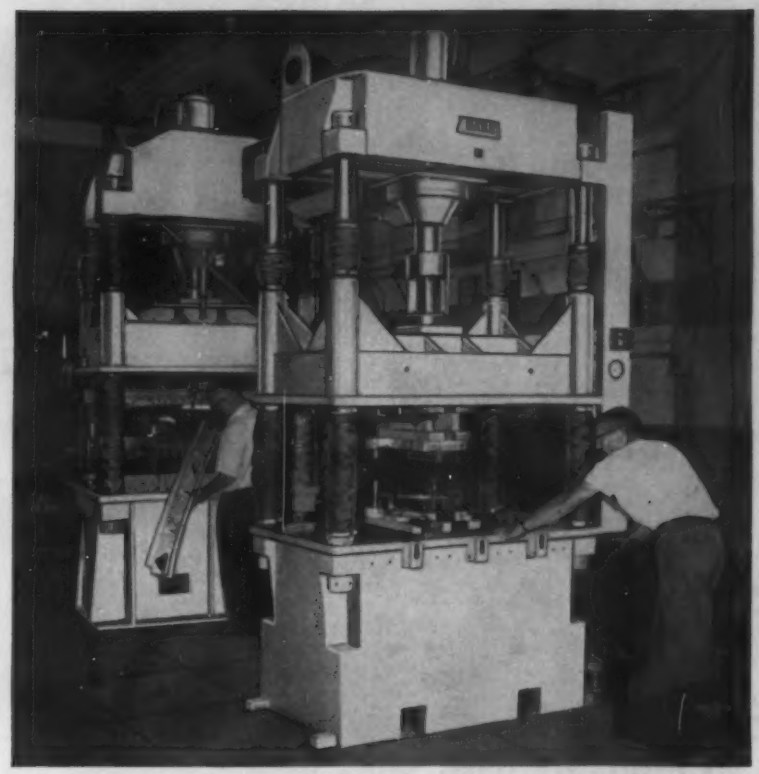
Two DAKE DIE TRYOUT PRESSES in Custom Die Shop?



Greenville Tool & Die Company, Greenville, Michigan, purchased a 150-ton Dake Hydraulic Die Tryout Press to relieve the workload on their mechanical facilities. After delivery, management discovered that the backlog of work for the Dake press was far greater than it was for the mechanical presses. Its smooth, accurate operation enabled it to easily handle presswork that would otherwise be difficult or impossible. A second Dake Hydraulic Die Tryout Press was installed because no other press could do as much work so well.

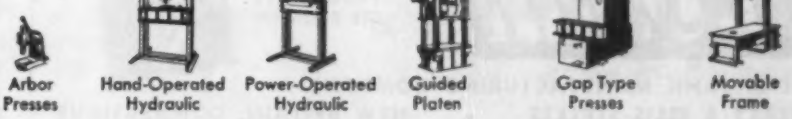
The Dake Die Tryout Presses can be stopped and reversed at any point in the stroke—diemakers can see just when and why blanks are "dragging" or "tearing," and their large daylight area allows the die to be "barbered" without removing it from the press.

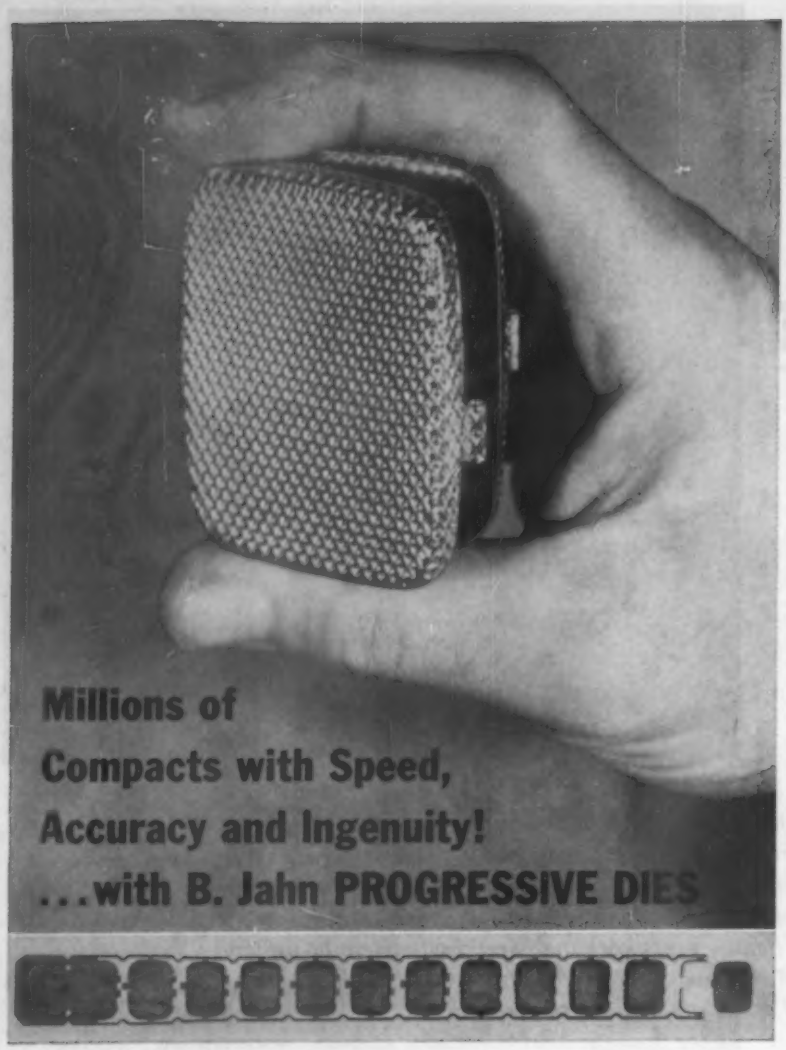
At the Greenville Tool & Die Company, Dake presses are also used to align punches, "shear-in" irregularly shaped surfaces, develop blank sizes and shapes, find the right redraw depths, and even straighten heat-treated die parts.

Dake Die Tryout Presses are available in 9 standard models from 25-ton to 300-ton capacity, and in custom engineered models to 600-ton capacity to meet special requirements. Send for Bulletin No. 330.

DAKE CORPORATION, 636 Robbins Road, Grand Haven, Michigan

DAKE PRESSES





A progressive die, so gentle it preserved the fine finish required on a lady's compact, so rugged it could dependably produce 12 million pieces at 105 strokes per minute, so accurate that two hinges and a catch on the first piece matched their mates on the last production piece needed.

This is the kind of die design ingenuity and production skill that goes into every B. Jahn die.

B. Jahn press facilities produced 1,060,000 pieces in two weeks to prove the die. This insured the perfection of a product advertised in LIFE magazine and sold world wide.

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EXCELLENCE IN DIE DESIGN — SAVINGS IN PRODUCTION

B. Jahn

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NAMES IN THE NEWS

Curtiss-Wright Corp has named **S Ralph Shaffer,** general manager and **L B Geithman** general sales manager of the Metals Processing Division, Buffalo. Mr Shaffer was formerly general manager, and Mr Geithman sales manager at the South Bend Division of Curtiss.

US Expansion Bolt Co, York, Pa, has elected **Charles H Schminke** vice president. He will continue to serve as general sales manager.

Lincoln Electric Co, Cleveland, has promoted **A F Boucher** from assistant sales manager to general sales manager.

Wyman-Gordon Co, Worcester, Mass, manufacturer of light and heavy forgings, has elected **Arnold L Rustay** a vice president. He has been technical director since 1957.

Nawide Machine Tools Division of Nationwide Engineering Service, Los Angeles, has named **James T Ashley** sales manager in charge of the company's line of circuit board drilling machines.

Screw & Bolt Corp of America, Pittsburgh, has announced that **Louis Berkman,** board chairman, has also been elected president following the retirement of **Donn D Greenshields** as president.

Package Machinery Co, East Longmeadow, Mass, manufacturer of automatic packaging equipment, plastic injection molding presses, and die casting machines, has elected **Lyman L Campbell** vice president, engineering. Prior to joining the firm, Mr Campbell was executive vice president and general manager of Lynch Corp, Anderson, Ind.

Anadite Inc, chemical milling and metal finishing firm, has named **Joseph E Trankla** general manager of the California Division. He has been serving as assistant general manager and director of research and development.

Packard Bell Electronics, Los Angeles, has named **Thomas R Maher** director of manufacturing of the Technical Products Division. Mr Maher joins Packard Bell following three years as manager of operations planning at Ryan Aeronautical Co's Electronics Division. •

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Write for McGill's Bearing Catalog #52-A, for engineering data with dimensional and capacity information on McGill needle type roller bearings. Ask about special precision ball and roller bearings.

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300 N. Lafayette Street, Valparaiso, Indiana

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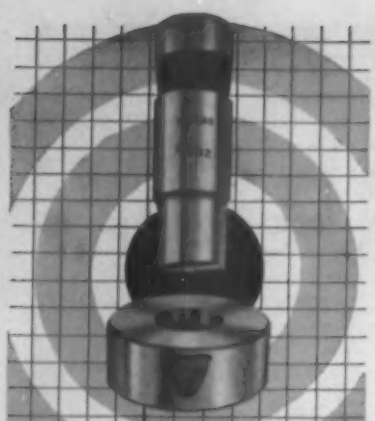

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NEW BOOKS...

MANUAL OF MACHINABILITY AND TOOL EVALUATION—*By Antoni Niedzwiedzki. Published by Heubner Publications, Inc., Cleveland 18, Ohio. 107 pages, 6 x 9 in., spiral bound, paper backed. Price $6.*

Here we have an attempt by an European-trained engineer to explain his philosophy of machining, especially as it relates to the carbide turning of steels. The author is widely read in foreign literature on machinability, he has worked abroad and in this country as a machining consulant, and he has performed certain researches in machinability.

As we would expect of a man who has had "a foot in both camps," the author brings us some information that is different, interesting, and possibly important. However, while the book is a manual, i.e., a small book, it is no handbook that can be applied by the shop estimator, process engineer or foreman. Actually the author develops 93 formulas, with supporting tables and charts but with virtually no "how to do it" information. Therefore, he has limited his audience to researchers in machinability and to those production engineers who are capable of devising shop recommendations from the basic formulas and concepts.

Mr Niedzwiedzki has set himself the task of proving that it is possible to predict tool wear in a given time for a given set of machining conditions. The intent is to show that tool wear is an exponential function of cutting speed, chip load or feed, depth of cut, *and diameter turned.* His information of the last subject is an important contribution, likewise his derivations of exponential values from the German AWS tables. He indicates that these differ from those used by the Carboloy Machinability Computor and the Kennametal Cutmeter for feed and depth of cut.

Issue is taken with the American practice of using average horsepower per cu in. per min. The author says that Europeans realize that horsepower is a function of feed and that coarse feeds are more economical. Therefore, he has derived a formula for specific chip pressure as a function of feed.

Eventually, formulas are derived for certain factors: (1) tool life, (2) feed, (3) depth of cut, and (4) diameter turned, and tables of data are presented for these factors. Another table of interest is one on specific chip pressure as a function of

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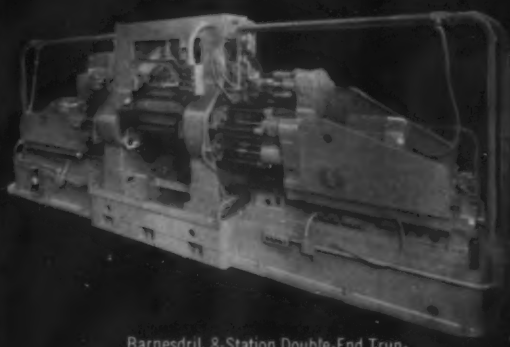
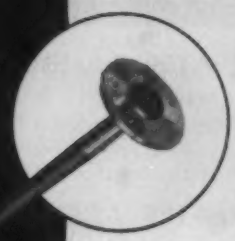
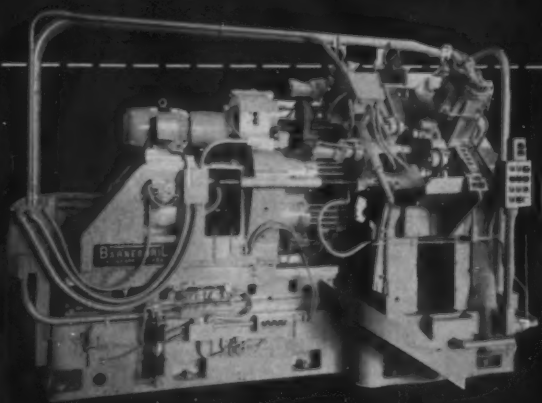


BarnesdriL 8-Station Double-End Trunnion-Type Machine drills, reams, chamfers, and probes rear axle shafts at the rate of 200 pieces per hour at 80%.

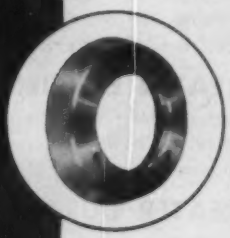


...TO SPEED PRODUCTION OF REAR AXLE SHAFTS

BarnesdriL's design improvement program led to the development of this 8-Station Trunnion-Type Machine. It produces as many rear axle shafts in one 8-hour shift as an older style Rotary Index Machine did in five 8-hour shifts.

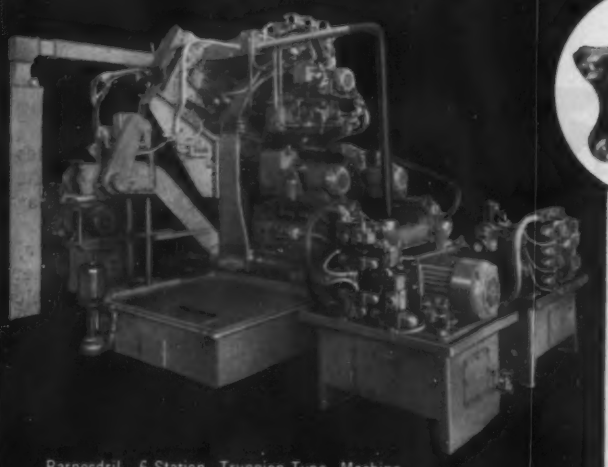


Special 8-Station Drum-Type Machine designed and built by Barnes Drill Co. for drilling, reaming, chamfering, tapping, and probing rear axle drive gears at 200 parts per hour at 80%.



...TO CUT COSTS ON REAR AXLE RING GEARS

This Drum-Type machine is a recent BarnesdriL engineering achievement to substantially increase production of ring gears for a large automobile company. Equally as important as increased production speed is the extreme tolerance accuracy and precision machining incorporated in this unit.



BarnesdriL 6-Station Trunnion-Type Machine performs drilling, threading spindle end, reaming, milling keyway, spot-facing, and probe operations on automotive steering knuckles at 208 pieces per hour at 80%.

...TO IMPROVE OUTPUT ON STEERING KNUCKLES

Another BarnesdriL Trunnion-Type Machine — a 6-Station Unit for machining steering knuckles. Application of a horizontal-type machine achieved more effective chip disposal, increased power through heavier construction, and higher speeds and feeds.

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NEW BOOKS . . .

chip load or feed and grade of steel. In other words, the author questions relative machinability data, as derived mainly for machining with HSS, and attempts to derive more precise information for carbide turning of steels, especially the alloy steels.

Practical aspects of the author's work begin to emerge with "Recommendation Sheets" for use by the estimator and shop man. Unfortunately, he gives recommendations for only one of the eight classes of steels he enumerates. This one table shows you the work rpm and the horsepower needed, if you know the required grade of finish, work diameter, tool style, chipbreaker style and feed.

Finally, the author contributes what he calls "crossed charts" for turning of steel and cast iron with either carbide or HSS. These tables or charts are offered to aid one in finding what improvement may be gained by a simultaneous change in speed and feed. However, as with other sections of the manual, no examples are given to aid the average reader to fix in his mind the value of the information and how to use it.—RL

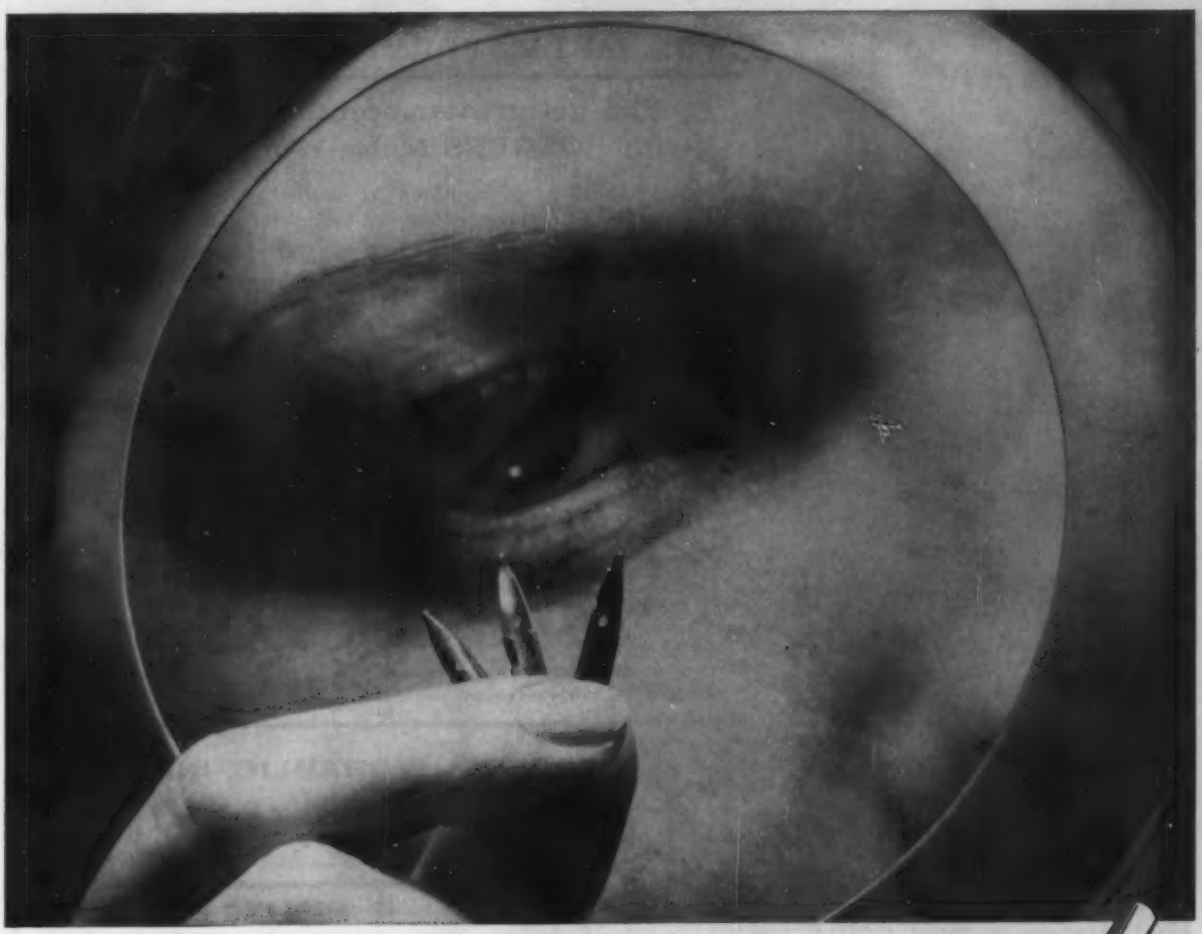
THE MILLION DOLLAR BEND — *By Charles Eisler. Published by the William-Frederick Press, 391 E 149 St, New York, N Y. 316 pages. Price $4.75.*

This autobiography draws its title from the bent-tube method of exhausting a tipless incandescent lamp. The bent tube resulted in a lamp making machine that did not infringe the patents of the "licensed manufacturers." It is one of the more than 50 patents Charles Eisler has been granted.

Eisler's famous patent battles—which he won—with General Electric and Westinghouse fill a large section of the book and provide a fascinating inside view of one major part of the litigation that seems always to have surrounded the electrical industry.

The book is also the story of his youth in Hungary and his experience when he came to the U S near the turn of the century.

In the appendix is a detailed description of the machines that Eisler has developed for lamp and tube making during the many years in which his company has been a major supplier to independent companies—in fact, has at times made independent companies possible.—*AA* •



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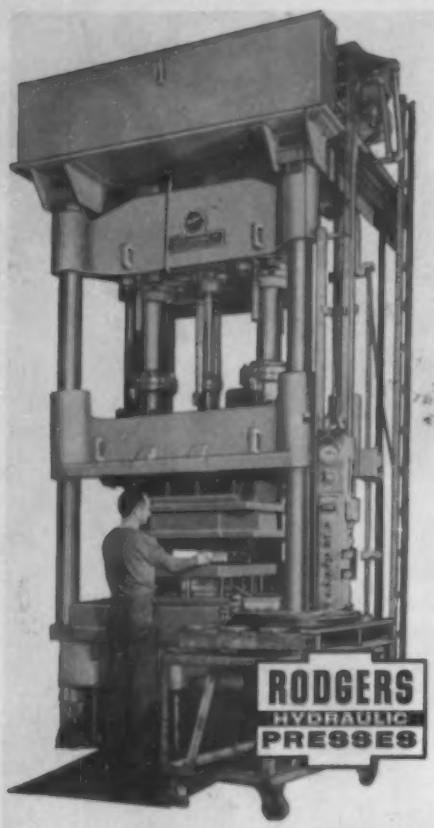

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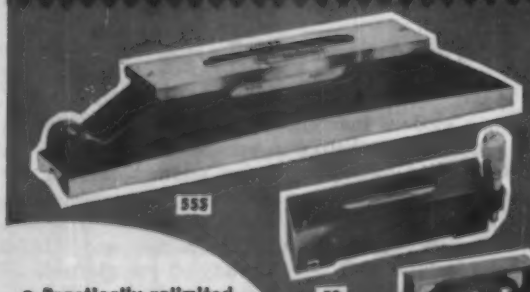

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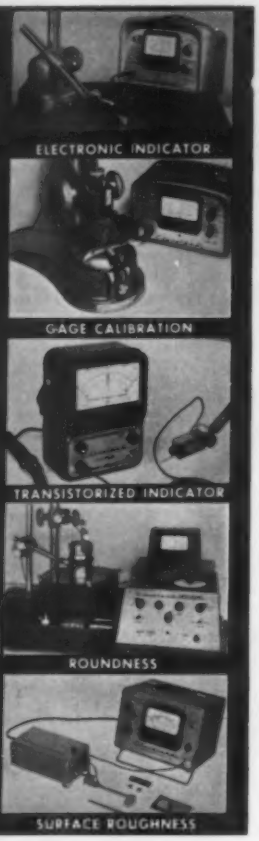

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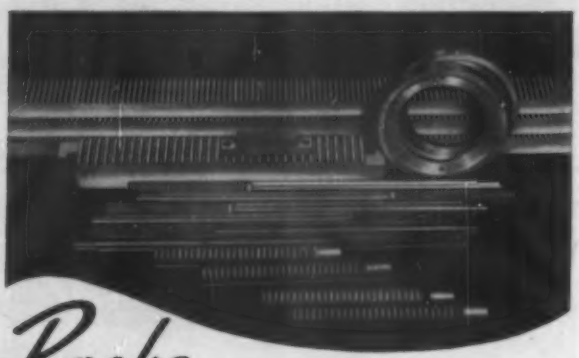

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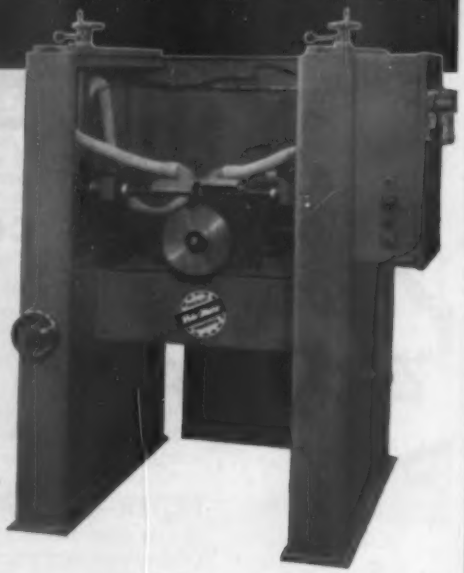

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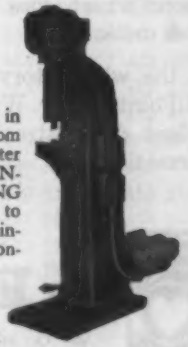

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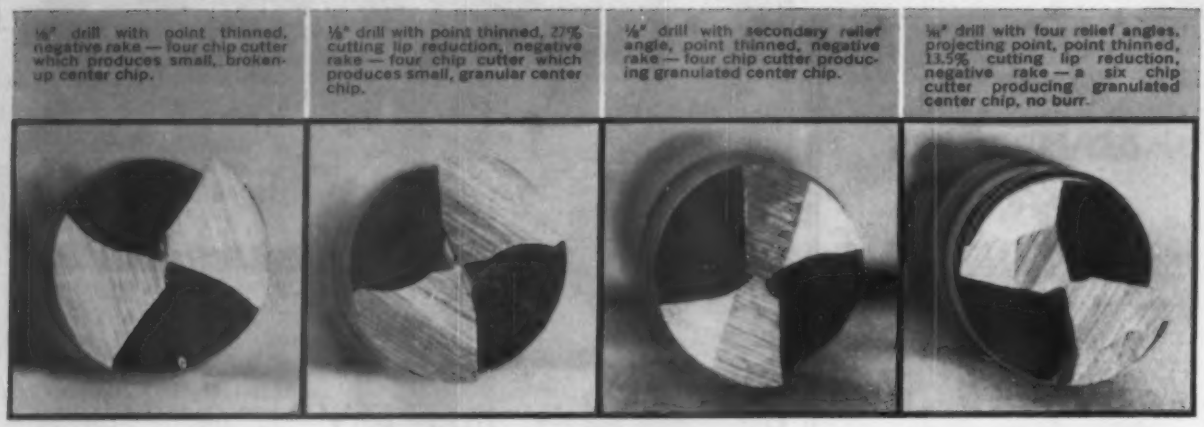
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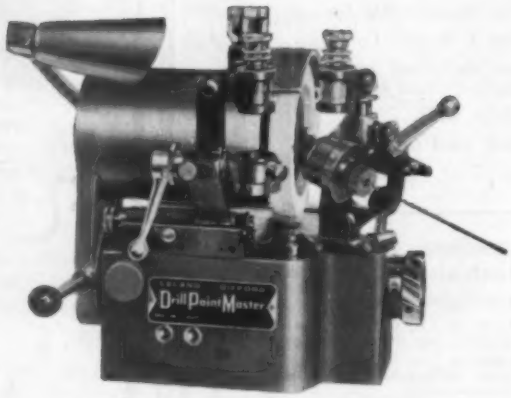

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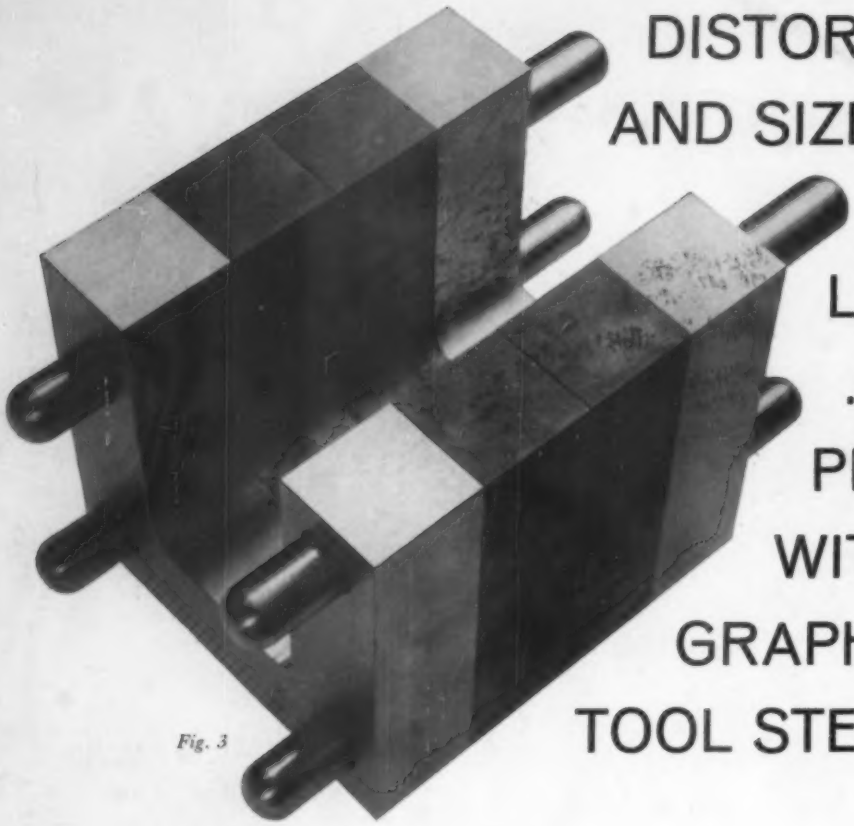

DISTORTION AND SIZE CHANGE HELD TO LESS THAN .0002" PER INCH WITH GRAPH-AIR® TOOL STEEL

Fig. 3

The test pieces pictured here demonstrate the dimensional stability of Graph-Air® tool steel that enables users to produce more intricate tools and dies.

Fig. 1 shows test piece dimensions. In the "U" shape, which is particularly sensitive to distortion in heat treating, the machining tolerance between any two holes is held to .0002". After heat treating, the specimens are fitted together by four pins having a diameter of .0003" under .500". The total assembly error under these circumstances could not exceed .0008". Distortion must be less than .0002" per inch during heat treatment for the pins to fit.

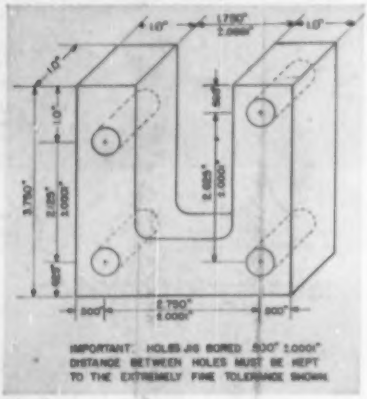

Fig. 1

The Graph-Air pieces tested were from different heats. They were air hardened from 1450°F. and double tempered at 400°F. Fig. 2 shows them as they pegged together easily, demonstrating no distortion. Fig. 3 top, shows the same specimens compared with two green, or as machined, parts. They matched perfectly again. *Graph-Air did not distort . . . did not change size.* Records indicate that no other tool steel passed this test when heat treated at its recommended hardening and tempering conditions.

Fig. 2

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